Flight Simulator includes enough ground reference points to allow you to perform ground-reference maneuvers, and the power and airframe strength to allow you to perform maximum performance flight maneuvers. Use the view selector to view ground reference points while you make turns. (Be sure to reselect the front view before you proceed to other maneuvers.) Set wind speed and direction to increase the challenge of your maneuvers.

Maneuver procedures are beyond the scope of this manual. We recommend you consult a flight training manual, such as the *Flight Training Handbook*, for details on how to perform the following maneuvers:

- Turns in the wind.
- "S" turns across a road.
- Turns around a point.
- Figure eights along and across a road.
- Figure eights around and on pylons.
- Line of sight to pylons.

All these maneuvers, as well as many stalls, can be performed in either auto-coordinated or uncoordinated flight modes.

Instrument Flight

Flight Simulator provides adequate instrumentation and enough VORs, airports, Instrument Landing Systems, and marker beacons to support Instrument Flight Rules (IFR) flight and approaches.

No ADF (Automatic Direction Finder) is available. Approaches at busy airports, such as Kennedy, Los Angeles International, and O'Hare, are not recommended without the use of this instrument. However, general approach techniques that do not require these instruments can be practiced at less congested airports. (The Flight Simulator allows you to land at busy airports without using ADF.)

Try IFR flight and approaches:

Many of the 81 airports in the Flight Simulator allow instrument approach. By tuning in to ATIS frequencies on the COM radio (see Charts 1 through 4 for frequencies for each airport), you can receive approach information, including approach-in-use, localizer frequency, etc. This combination of information is normally supplied by ATIS, approach control, the tower, and approach plates.

If ATIS is not available at a particular airport, tune in to the tower by selecting the VOR frequency with your COM radio. This information scrolls across the top of the screen. If it moves too fast, enter the editor, move the arrow to the Communication Rate parameter, and reduce the speed by entering a smaller number.

A discussion of instrument approach techniques is beyond the scope of this manual. If you are not an instrument-rated pilot, you can find details of instrument approaches and flying in training manuals such as *Instrument Flying* by Richard L. Taylor.

World War I Ace

WWI Ace is a three-dimensional battle game that lets you test your flying skills against those of your computer-controlled enemy. You will go on several bombing runs and engage in numerous dogfights with your enemy. Your goal is to down five enemy aircraft and to become a WWI Ace.

To begin:

Begin the game by entering the editor and setting the Europe 1917 parameter to "1," or enter "7" next to the User Mode parameter. Press Esc to reenter flight mode. Figure 29 shows the battleground. You are currently positioned on the runway of Friendly Base 1 (your main airbase). You are fueled, armed, and ready for takeoff.

Friendly Base 1: Fuel and ammunition available
Friendly Base 2: Fuel only available

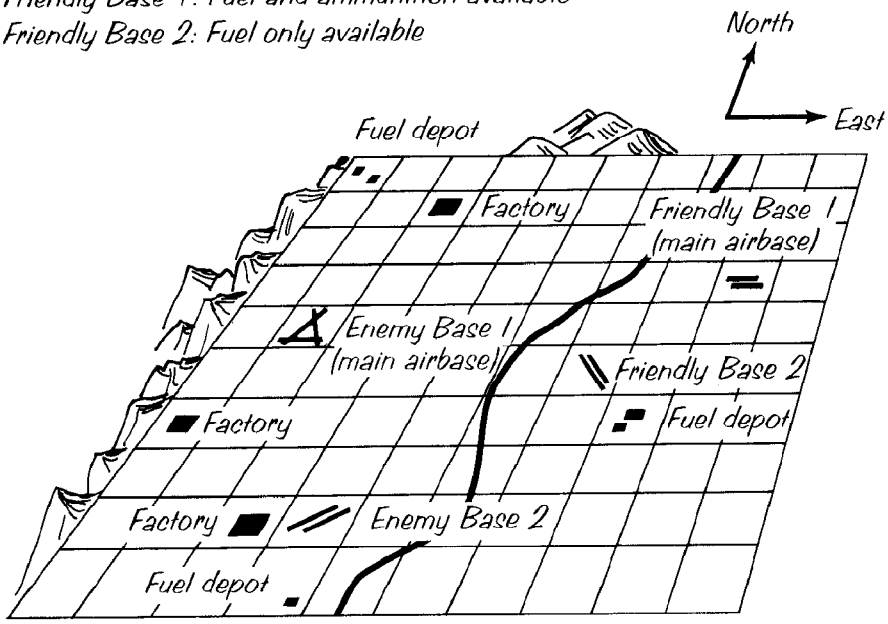


Figure 29. WWI Ace Battleground

To declare war:

A truce is in effect and battle will not begin until you declare war by pressing the War key (Shift *W* on the PCjr, *W* on the PC).

The enemy occupies the territory west of the river. They have established two airbases, a fuel depot for each, and several factories. Six enemy fighters stand ready to protect the fuel depots and the factories. It is your duty to shoot down as many of the enemy fighters as possible and bomb the depots and factories.

To release bombs:

To locate your targets, you will have to use the view selector (in conjunction with the keys on the control yoke). The downward view includes a bomb sight. The bomb sight helps direct you over your target so you have a better chance of scoring a hit. Pressing the *X* key on either the PCjr or PC releases one bomb.

To become an Ace, you must down at least five enemy aircraft. You can earn additional points for other actions.

Action	*Points*
Downing an enemy aircraft	1
Bombing a factory	20
Destroying a fuel depot	10

These extra points won't make you an Ace, but they will indicate your skill as a fighter. Your score is displayed on the attack radar screen.

To request a War Report:

The Report key (Shift R on the PCjr, R on the PC) causes the simulation to pause and displays the War Report that indicates your present status. Pressing the key again will return you to the game.

The enemy pilots have orders to intercept any invader. However, each pilot has different instructions for when to launch and when to return to base. The skills of your opponents vary. The Aces are proficient and score quickly. Their lesser-skilled compatriots are less likely to hit you.

The enemy flies a wide variety of fighter aircraft. Their fleet contains two planes that are fast and rugged, but equipped with unreliable guns; one plane that is fast and easily maneuvered; one that is a fair fighter, capable of medium range speed, maneuvered fairly easily, and equipped with average guns; and two super fighters. Be assured that the enemy Aces will be in the best planes.

Although World War I aircraft were not equipped with radar, when you play WWI Ace, radar is implemented to compensate for the viewing limitations of the three-dimensional screen.

To use radar:

The lower right corner of the instrument panel becomes your attack radar screen. The attack radar screen displays your score, as well as various messages about war occurrences. It also has a bomb indicator and an ammunition indicator, which display your current bomb and ammunition supply.

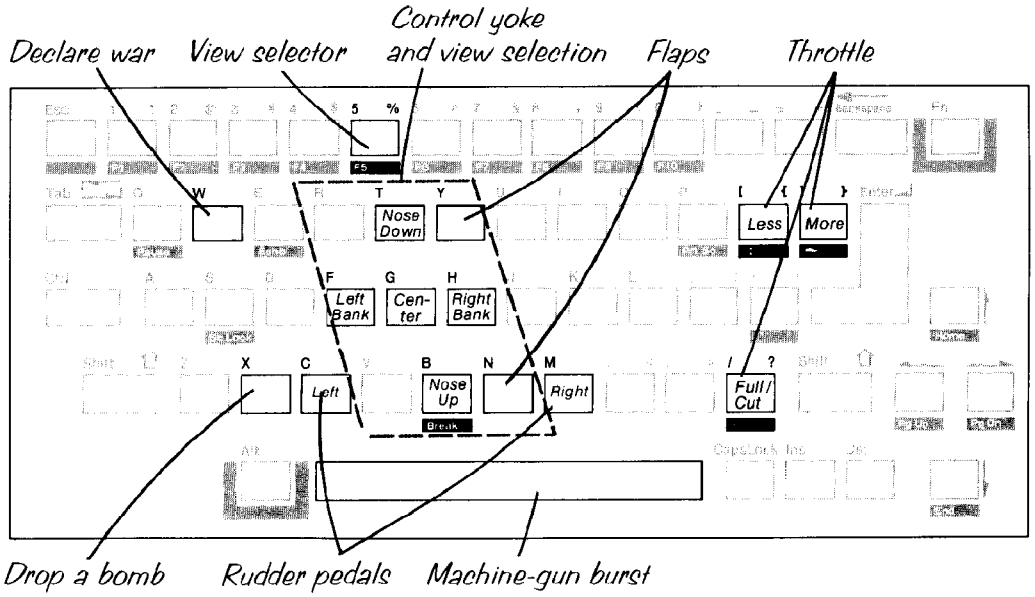
The small plane in the center of the radar screen shows your position and orientation. Enemy aircraft are represented by dots on the screen. These dots are color-coded to indicate their altitude.

Color	*Meaning*
Orange	Enemy below you
White	Enemy within 100 feet above/below you
Green	Enemy above you

Note If you have a black and white monitor, we recommend you rely on your out-the-window display to determine the position of the enemy. Though you will be able to distinguish planes within 100 feet above and below you (the bright dots on the radar screen), you will not be able to determine whether the dim dots represent planes far above you or planes far below you.

The radar has a radius of approximately 1 mile and displays the enemy positions when the forward view is selected.

When you play the WWI Ace game, the regular instrument panel is augmented with fighter aircraft instrumentation. The yoke, flap, rudder, and throttle controls perform the same functions they do in regular flight mode. In addition, the Space Bar or joystick push buttons control gun-fire, and the X key releases a bomb. As previously mentioned, the Report key displays the War Report and the War key commences action (begins the war). If you choose to use a joystick in the WWI Ace game, be sure to calibrate it before entering the game. If you need to recalibrate, exit the game temporarily to do so. Figures 30 and 31 show the battle mode flight controls for the PCjr and the PC.



Note: For certain controls, press Shift and one of these keys:

Shifted Key	Result
R	Displays war report
W	Declares war

Figure 30. WWI Ace Battle Mode Flight Controls for the PCjr

Note The Europe 1917 parameter must be set to 1 using the editor for these controls to take effect.

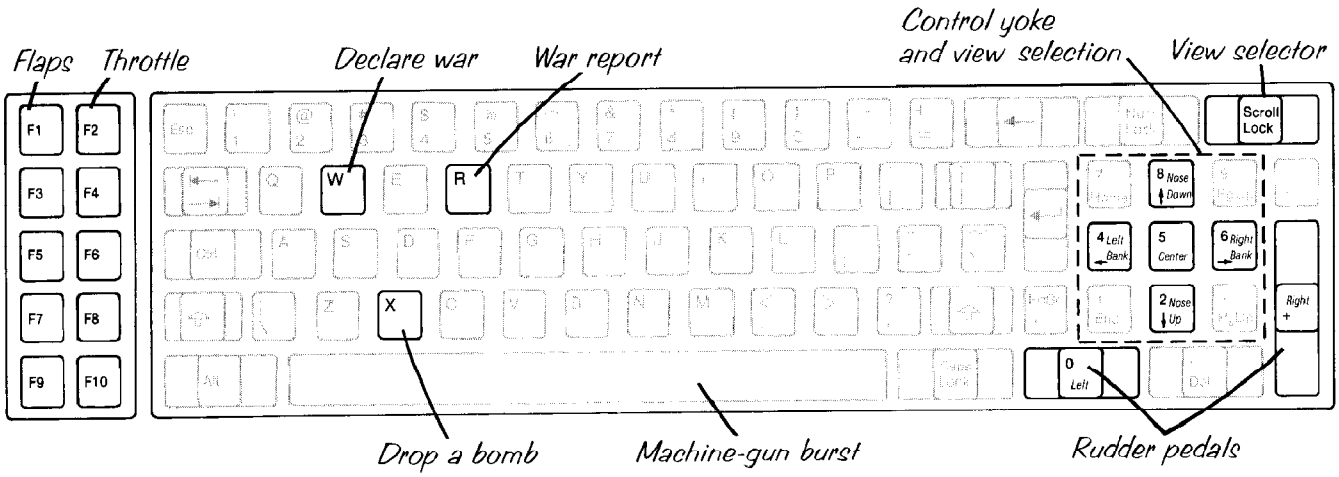


Figure 31. WWI Ace Battle Mode Flight Controls for the PC

When you're ready to start:

First, scout the enemy's territory. Decide where you want to be when the battle begins. (You do not have to be at your airbase to declare war. In fact, you will probably find it to your advantage to begin elsewhere.)

After you have declared war, you will have to watch the radar screen and look out the windshield for the approach of the enemy. Move as close to an enemy plane as possible and fire by repeatedly pressing the Space Bar or either joystick's push button. You have a better than average chance of hitting your enemy if the enemy is anywhere on the screen and within range of your gun. Your gun has excellent straight range, but poor side range. Consequently, you must be very close to a plane to hit it when it moves to the sides of the screen.

You, too, are open for attack. Although the enemy can and will shoot you down, every firing does not register a hit for them. Each enemy pilot's success will depend on his skill level. Every hit the enemy scores reduces the efficiency of your plane. If you are hit and your aircraft has been damaged (if it is acting strangely, losing fuel, or dropping oil pressure), return to base for repairs and refueling.

Refueling at Friendly Base 1 automatically replenishes your bomb supply. You can carry only five bombs at a time, so you can destroy a maximum of five targets (fuel depots and factories) per mission. Friendly Base 2 only has fuel, so any time you need more bombs you must return to Friendly Base 1.

Six enemy fighters patrol the skies above the enemy airbases. Their location varies from game to game and during the game. Damaged enemy planes are replaced while you refuel and repair your plane.

Now that you know the rules, declare war. Good luck!

Reference

This section includes information about your plane. It also contains a diagram of the cockpit, airport maps, and a glossary.

Reference Figures and Charts

The Standardized Instrument Cluster

1. Airspeed indicator (knots)
2. Attitude indicator (artificial horizon)
3. Altimeter
4. Turn coordinator with slip/skid indicator
5. Heading indicator (directional gyro)
6. Vertical speed (rate of climb indicator)

Other Instruments and Indicators

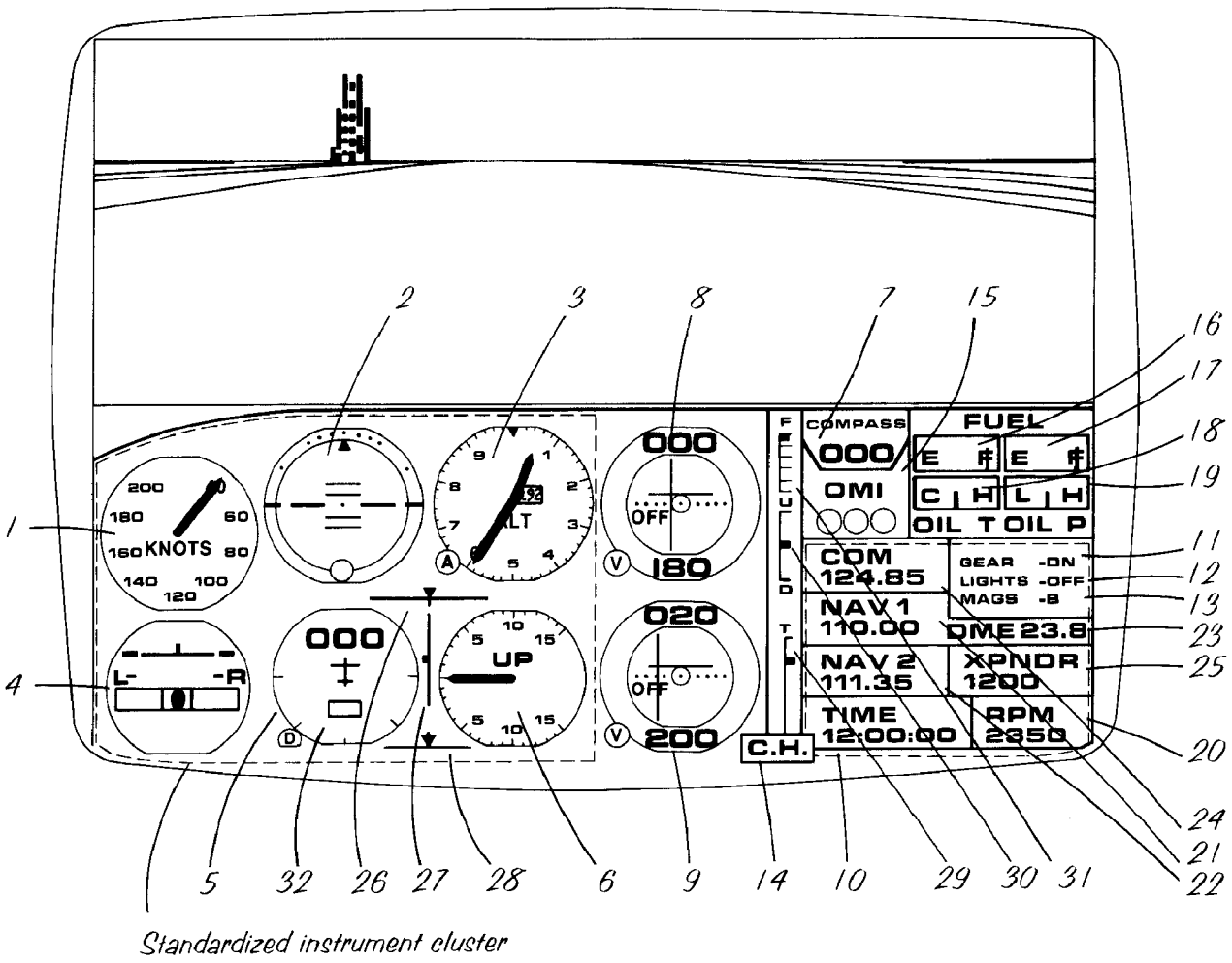
7. Magnetic compass
8. Omni-Bearing Indicator with glideslope (NAV 1)
9. Omni-Bearing Indicator with glideslope (NAV 2)
10. Clock
11. Gear indicator
12. Lights indicator
13. Magnetos indicator
14. Carburetor heat indicator
15. Outer, Middle, and Inner marker lights
16. Left wing fuel tank gauge
17. Right wing fuel tank gauge
18. Oil temperature gauge
19. Oil pressure gauge
20. Tachometer

Radios

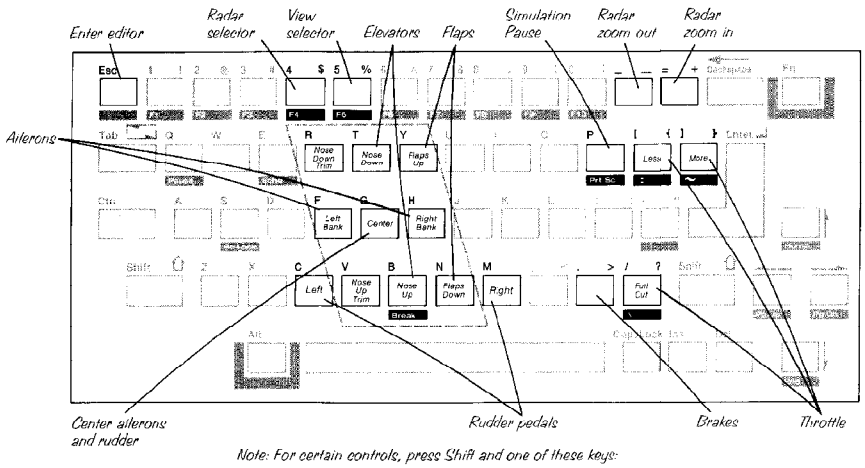
21. NAV 1 radio
22. NAV 2 radio
23. DME
24. COM radio
25. Transponder

Control Position Indicators

26. Aileron position indicator
27. Elevator position indicator
28. Rudder position indicator
29. Throttle position indicator
30. Elevator trim indicator
31. Flap position indicator
32. Mouse control of view select



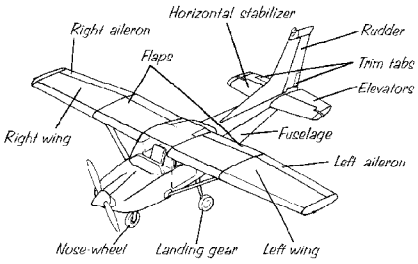
Reference Figure 1. The Three-Dimensional Display and Instrument Panel



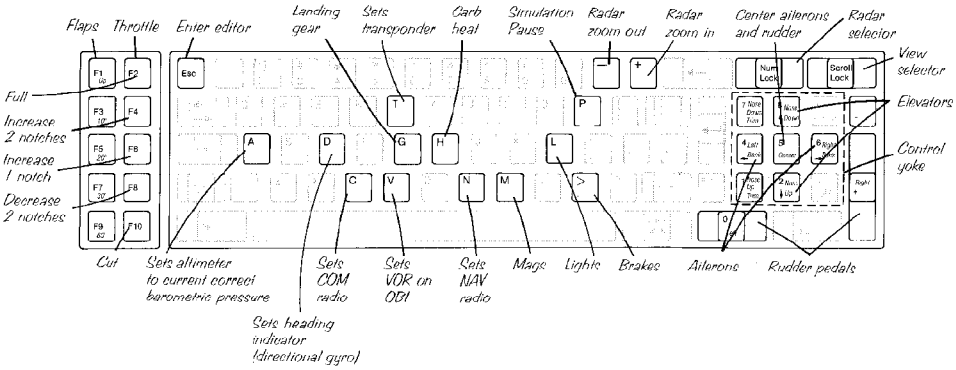
Note: For certain controls, press Shift and one of these keys:

Shifted Key	Result
A	Sets the altimeter to the current barometric pressure
C	Sets the COM radio frequency
D	Sets the directional gyro heading indicator to the magnetic compass
G	Raises or lowers the landing gear
H	Toggles the carburetor heat on or off
L	Toggles the instrument and running lights on or off
M	Adjusts the magnetos
N	Sets the NAV radio frequency
T	Sets the transponder "squawk"
V	Sets the OBI to a VOR frequency

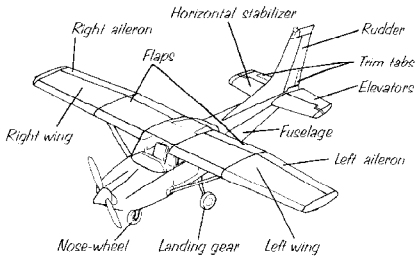
Reference Figure 2. Complete Control Key Set for the PC jr.



Basic Aircraft Components



Reference Figure 3. Complete Control Key Set for the PC



Basic Aircraft Components

Airport Directory

NEW YORK AND BOSTON AREA

CITY	*AIRPORT*	*NORTH*	*EAST*	*ALT.*	*F (Fuel)*	*ILS (Ruy/Freq.)*
Block Island	Block Island State	17352	21749	105	*	
Boston	General Edward Lawrence Logan Intl.	17899	21853	20	*	
Bridgeport	Igor I. Sikorsky Memorial	17287	21249	10	*	
Chester	Chester	17404	21434	416		
Danbury	Danbury Muni	17360	21120	457		
Danielson	Danielson	17617	21607	239		
Farmingdale	Republic	17089	21177	81		
Hartford	Hartford-Brainard	17551	21371	19		
Islip	Long Island MacArthur	17132	21278	99		
Martha's Vineyard	Martha's Vineyard	17490	22043	68	*	24/108.7
Meriden	Meriden Markham Muni	17447	21327	102		
New Haven	Tweed-New Haven	17339	21322	13		
New York	John F. Kennedy Intl.	17034	21065	12	*	
New York	LaGuardia	17091	21026	22		
Oxford	Waterbury-Oxford	17422	21229	727		
Southbridge	Southbridge Muni	17733	21543	697		
White Plains	Westchester Co.	17226	21065	439		
Willimantic	Windham	17573	21521	246		
Windsor Locks	Bradley Intl.	17638	21351	174		

North and east coordinates are canted at +10° (clockwise) to compensate for orthogonal coordinate grid overlaid on Lambert conformal conic projection.

CHICAGO AREA

CITY	AIRPORT	NORTH	EAST	ALT.	F (Fuel)	ILS (Rwy/Freq.)
Aurora	Aurora Muni	17152	16393	706		
Bloomington	Bloomington-Normal	16593	16246	875		
Champaign (Urbana)	University of Illinois Willard	16400	16465	754	*	31/109.1
Chicago	Chicago Midway	17156	16628	619	*	
Chicago	Chicago-O'Hare Intl.	17243	16578	667	*	
Chicago	Lansing Muni	17049	16697	614		
Chicago	Merrill C. Meigs	17189	16671	592	*	
Chicago/Blue Island	Howel	17100	16627	600		
Chicago/Schaumburg	Schaumburg Air Park	17247	16515	795		
Chicago (West Chicago)	DuPage	17213	16466	757		
Danville	Vermilion Co.	16471	16685	695		
Dwight	Dwight	16874	16404	630		
Frankfort	Frankfort	17025	16596	775		
Gibson City	Gibson City Muni	16594	16461	759		
Joliet	Joliet Park District	17038	16490	582		
Kankakee	Greater Kankakee	16846	16597	625	*	
Monee	Sanger	16980	16646	786		
Morris	Morris Muni	17004	16413	588		
New Lenox	New Lenox-Howell	17025	16571	745		
Paxton	Paxton	16578	16507	780		
Plainfield	Clow Intl.	17116	16502	670		
Romeoville	Lewis University	17081	16518	672		
Urbana	Frasca Field	16448	16482	735		

North and east coordinates align with orthogonal coordinate grid overlaid on Lambert conformal conic projection.

SEATTLE AREA

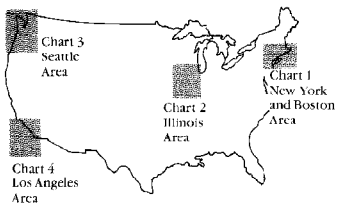
CITY	AIRPORT	NORTH	EAST	ALT.	F (Fuel)	ILS (Rwy/Freq.)
Alderwood Manor	Martha Lake	21502	6670	500		
Arlington	Arlington Muni	21616	6737	137		
Auburn	Auburn Muni	21290	6586	57		
Bremerton	Bremerton National	21407	6470	481		
Everett	Snohomish Co.	21525	6665	603	*	16/109.3
Issaquah	Issaquah	21362	6668	500	*	
Monroe	Flying F. Ranch	21481	6738	50		
Olympia	Olympia	21218	6343	206	*	
Puyallup	Pierce Co.-Thun Fld.	21206	6534	530		
Port Angeles	William R. Fairchild Intl.	21740	6375	288	*	
Port Orchard	Port Orchard	21373	6483	370		
Renton	Renton Muni	21351	6612	29		
Seattle	Boeing Fld./King Co. Intl.	21376	6596	17	*	
Seattle	Seattle-Tacoma Intl.	21343	6584	429	*	
Shelton	Sanderson Fld.	21353	6316	278		
Snohomish Co. (Paine Field)	see Everett					
Snohomish	Harvey Fld.	21505	6711	16		
Spanaway	Shady Acres	21201	6501	425		
Spanaway	Spanaway	21215	6491	385		
Tacoma	Tacoma Narrows	21300	6480	292		

North and east coordinates are canted at −21° (counter-clockwise) to compensate for orthogonal coordinate grid overlaid on Lambert conformal conic projection.

LOS ANGELES AREA

CITY	AIRPORT	NORTH	EAST	ALT.	F (Fuel)	ILS (Rwy/Freq.)
Carlsbad	McClennan-Palomar	14931	6112	328		
	Catalina (PVT)	15149	5744	1602	*	
Chino	Chino	15319	6079	650		
Compton	Compton	15334	5859	97		
Corona	Corona Muni	15280	6083	533		
El Monte	El Monte	15397	5952	296		
Fallbrook	Fallbrook Community Airpark	15023	6144	708		
Hawthorne	Hawthorne Muni	15358	5831	63		
Huntington Beach	Meadowlark	15244	5911	28		
LaVerne	Brackett Fld.	15378	6038	1011		
Los Angeles	Hughes (PVT)	15386	5808	22	*	
Los Angeles	Los Angeles Intl.	15374	5805	126	*	
Oceanside	Oceanside Muni	14974	6095	28		
Ontario	Ontario Intl.	15347	6099	952		
Riverside	Riverside Muni	15288	6141	816		
San Diego	San Diego Intl.-Lindbergh Fld.	14761	6102	15	*	
Santa Ana	John Wayne Airport/Orange County	15211	5961	54	*	
Santa Monica	Santa Monica Muni	15402	5799	175	*	
Torrance	Torrance Muni	15308	5815	101		
Van Nuys	Van Nuys	15498	5811	799	*	16R/111.3

North and east coordinates are canted at −19° (counter-clockwise) to compensate for orthogonal coordinate grid overlaid on Lambert conformal conic projection.



Legend

Civil---Public use airport

Restricted/Private---Nonpublic use airport, having emergency use or landmark value

Rotating light in operation, sunset to sunrise

NAME
CT 124.4
206
Airport name
Control Tower (CT)---Primary frequency
Elevation in feet

NAME
ATIS 118.0
Airport name
Automatic Terminal Information Service ---
Communication radio frequency

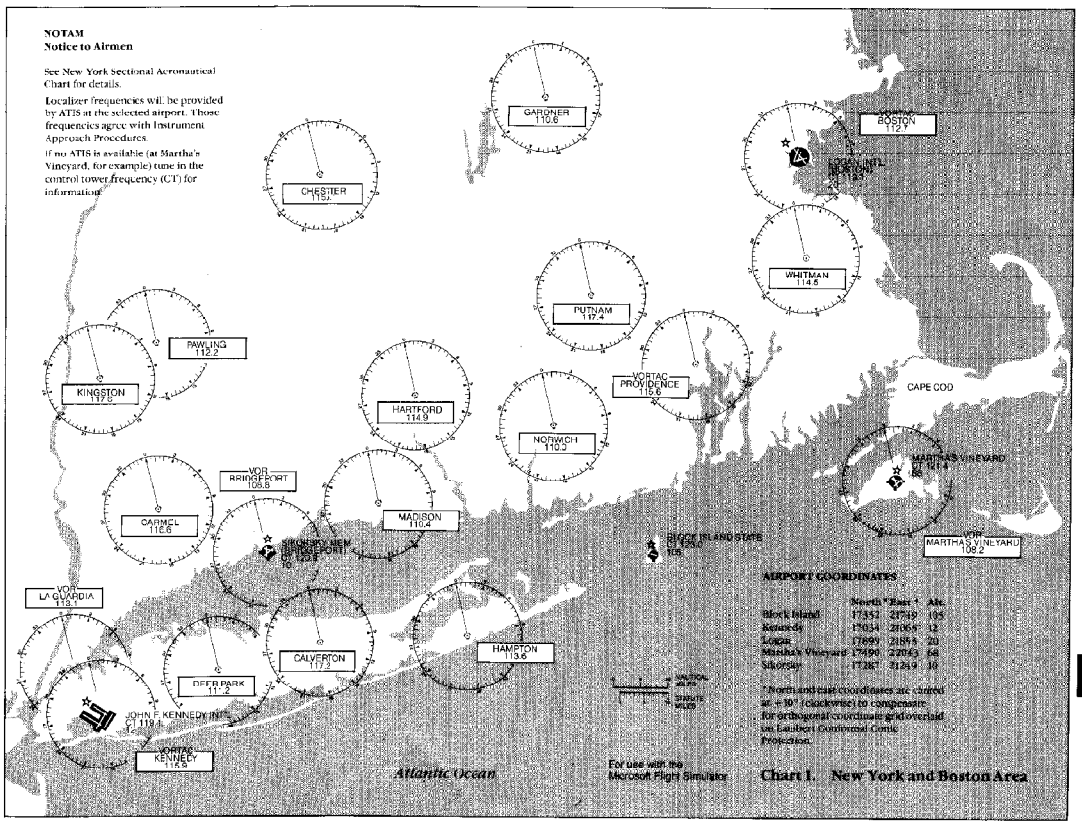
NFCT
Non-Federal Control Tower

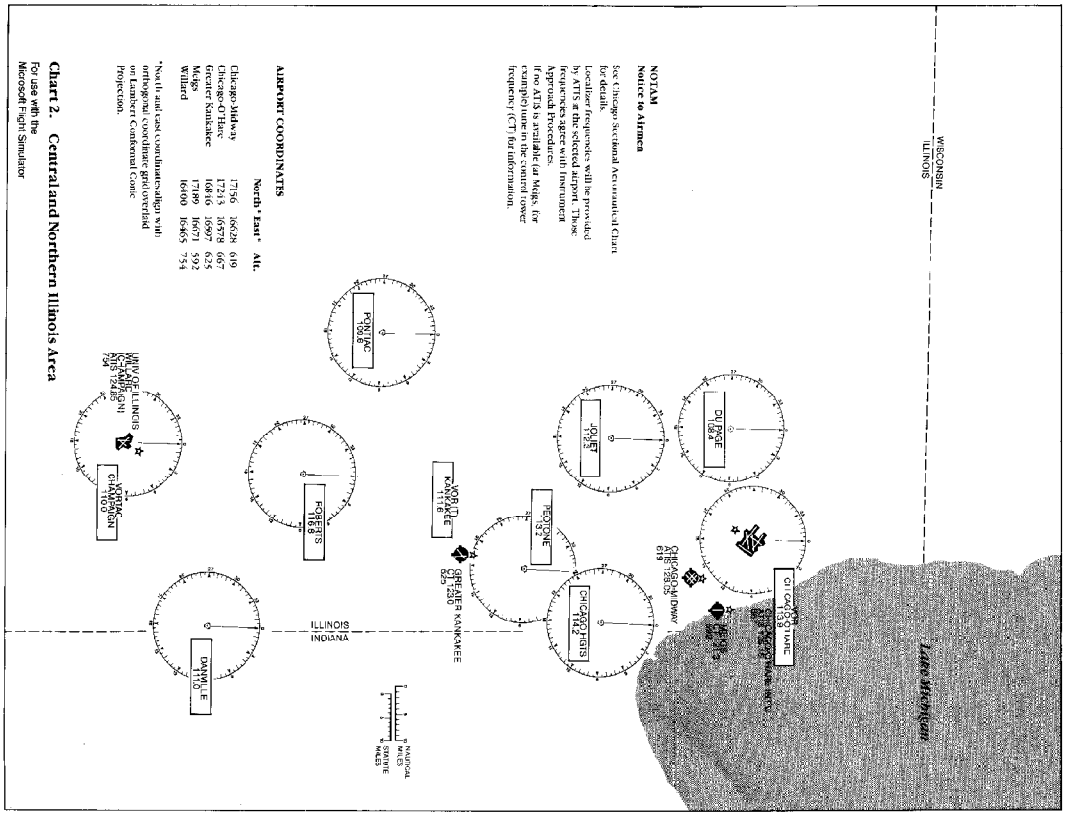
VOR (VHF Omni Range)---Civilian navigation beacon

VORTAC (VHF Omni Range TACAN)---Civilian and military navigation beacon

JOLIET
112.3
VOR---Navigation radio frequency

VOR (T)
KANKAKEE
111.6
VOR(T)---Terminal VOR




WISCONSIN
ILLINOIS
Lake Michigan
NOTAM
Notice to Airmen
See Chicago Sectional Aeronautical Chart for details.
Identifier frequencies will be provided by ATIS at the selected airport. Those frequencies are not published on Approach Procedures.
If no ATIS is available (at Meigs) for complete tune in the control tower frequency (CT) for information.
AIRPORT COORDINATES
North* East* Alt.
Chicago-Midway 17556 16628 619
Chicago-O'Hare 17513 16579 667
Greater Kankakee 16816 16907 625
Meigs 17849 16671 592
Willard 16600 16465 754
*Nav-II and GAS coordinates align with orthogonal coordinate grid, overlaid on Lambert Conformal Conic Projection.
Chart 2. Central and Northern Illinois Area
For use with the Microsoft Flight Simulator
PONTIAC
DU PAGE
JOLIET
FOREST CITY
PEOTONE
WORLD KANKAKEE
CHICAGO-HGTS
DANVILLE
ILLINOIS
INDIANA
GREATER KANKAKEE
NAUTICAL MILES
STATUTE MILES

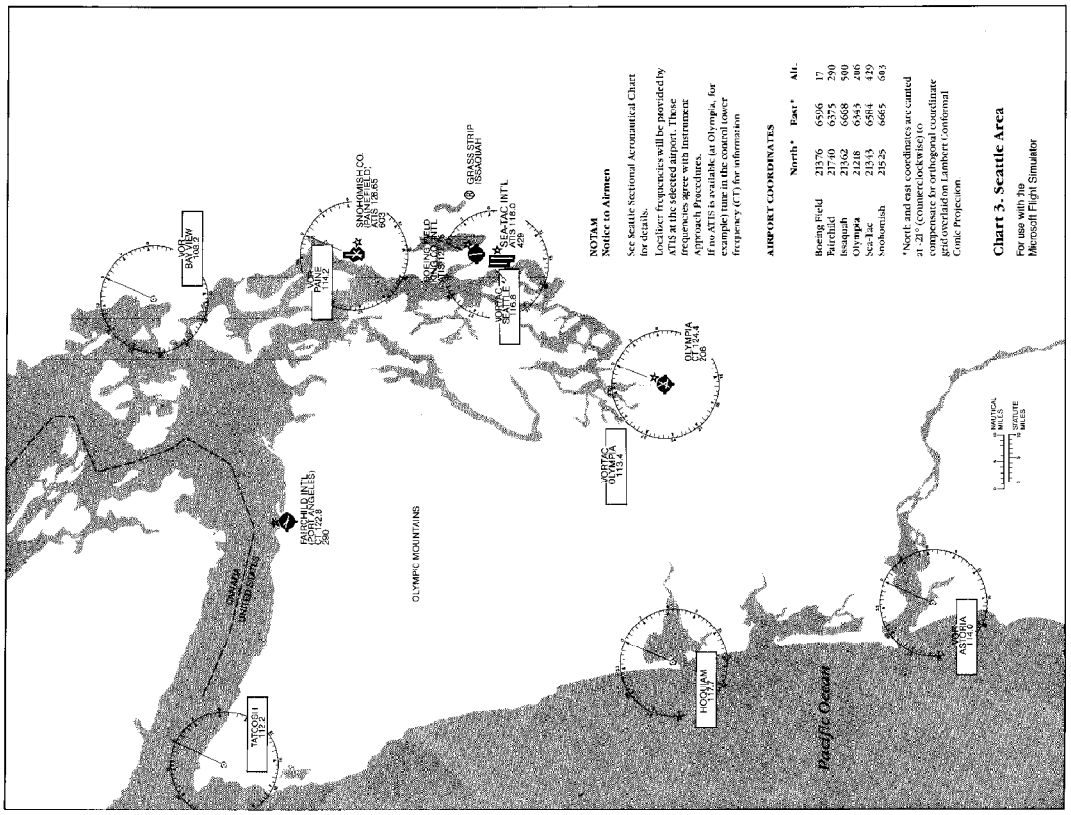


Chart 3. Seattle Area
For use with the
Microsoft Flight Simulator
NOTAM
Notice to Airmen
See Seattle Sectional Aeronautical Chart for details.
Localizer frequencies will be provided by ATIS at the selected airport. These frequencies agree with instrument approach procedures.
If no ATIS is available (at Olympia, for example) tune in the control tower frequency (CT) for information
AIRPORT COORDINATES
North* East* Alt.
Boeing Field 21576 6596 17
Fairchild 21760 6575 590
Hoquiam 21562 6668 9
Olympia 21218 6543 206
Sea-Tac 21343 6584 429
Snohomish 21525 6665 603
*North and east coordinates are counted at 21° (counterclockwise) to compensate for orthogonal coordinate grid overlaid on Lambert conformal Conic Projection
OLYMPIC MOUNTAINS
Pacific Ocean
NAUTICAL MILES
STATUTE MILES

NOTAM
Notice to Airmen

See Los Angeles Sectional Aeronautical Chart for details.

Localizer frequencies will be provided by ATIS at the selected airport. Those frequencies agree with Instrument Approach Procedures.

If no ATIS is available (at Catalina, for example) tune in the control tower frequency (CT) for information.

AIRPORT COORDINATES

	North*	East*	Alt.
Catalina	15149	5744	1602
Hughes	15386	5808	22
John Wayne-Orange Co.	15211	5961	54
Los Angeles	15374	5805	126
San Diego	14761	6102	15
Santa Monica	15402	5799	175
Van Nuys	15498	5811	799

*North and east coordinates are canted at -19° (counterclockwise) to compensate for orthogonal coordinate grid overlaid on Lambert Conformal Conic Projection.

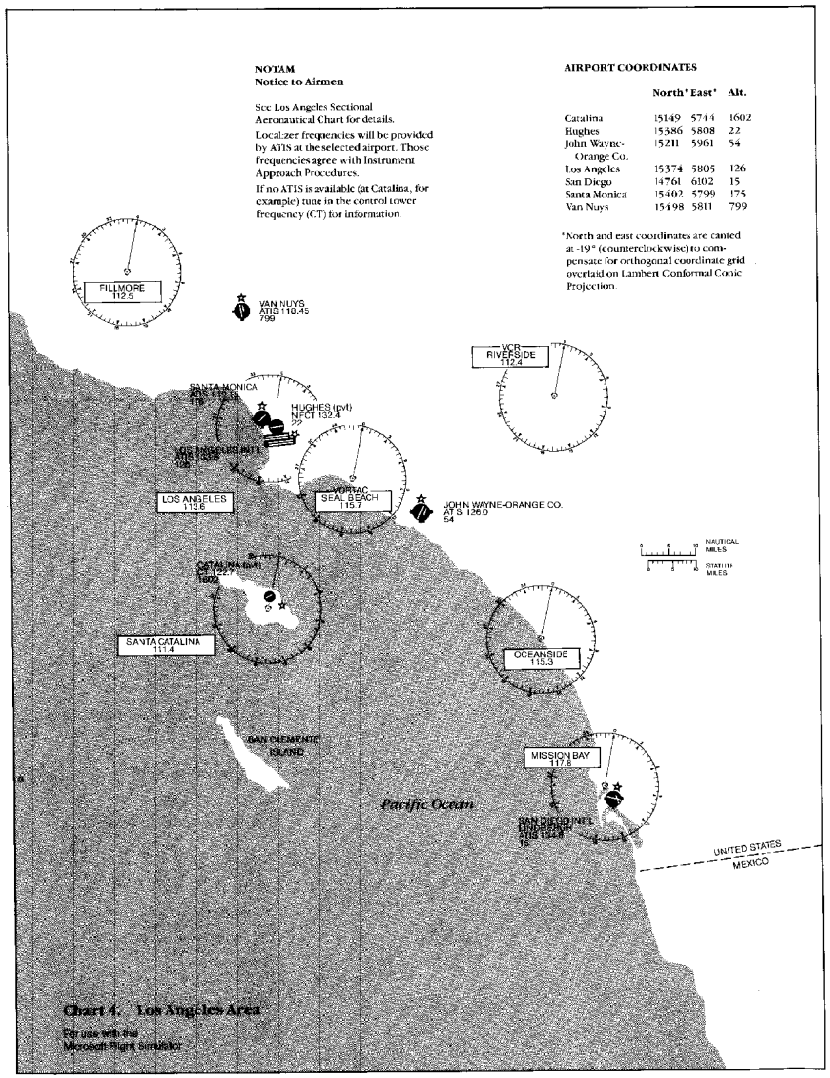
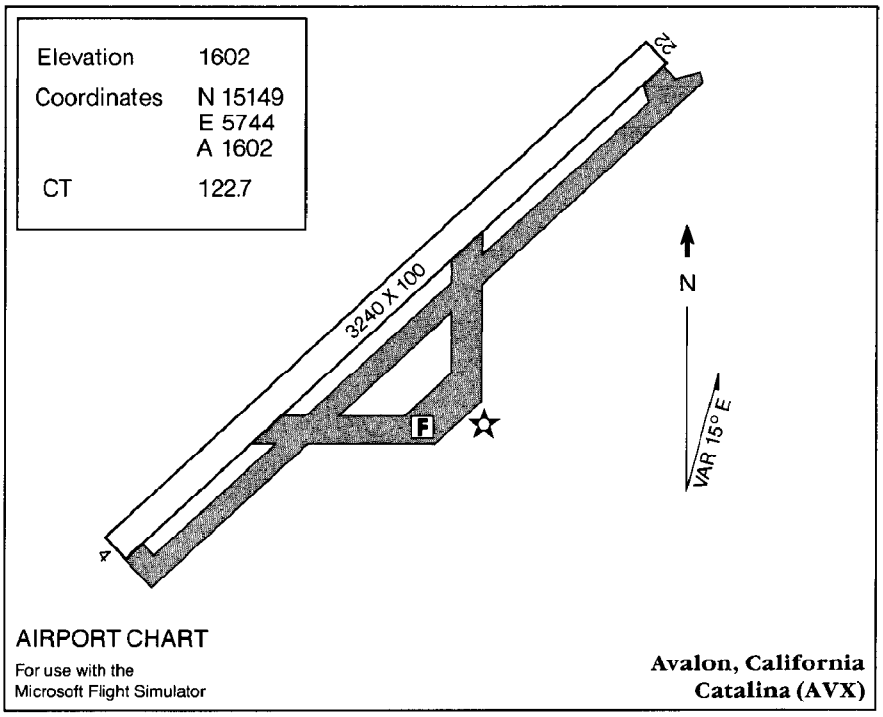
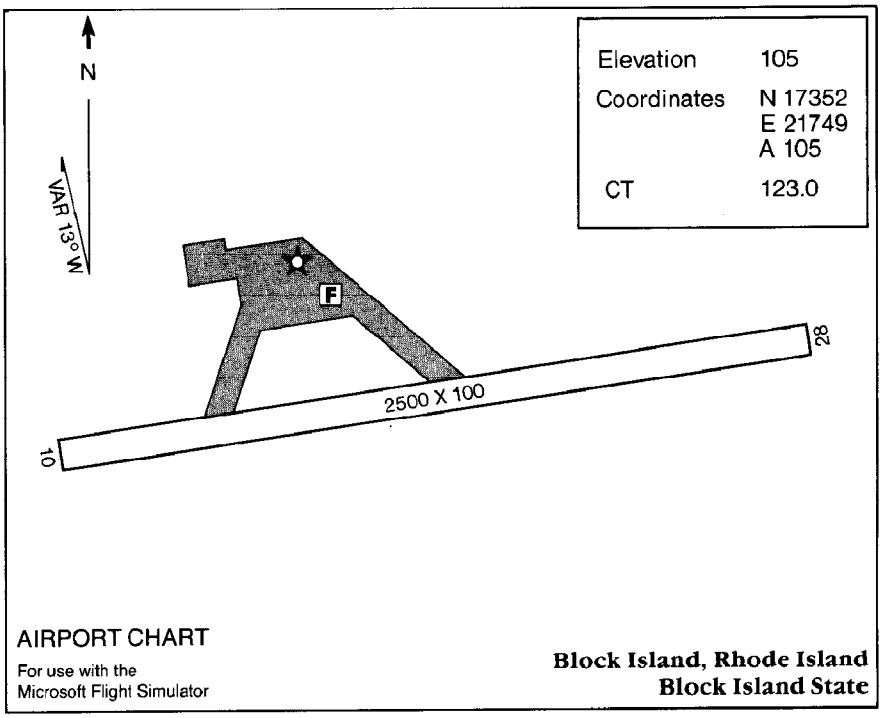


Chart 4. Los Angeles Area
For use with the Microsoft Flight Simulator

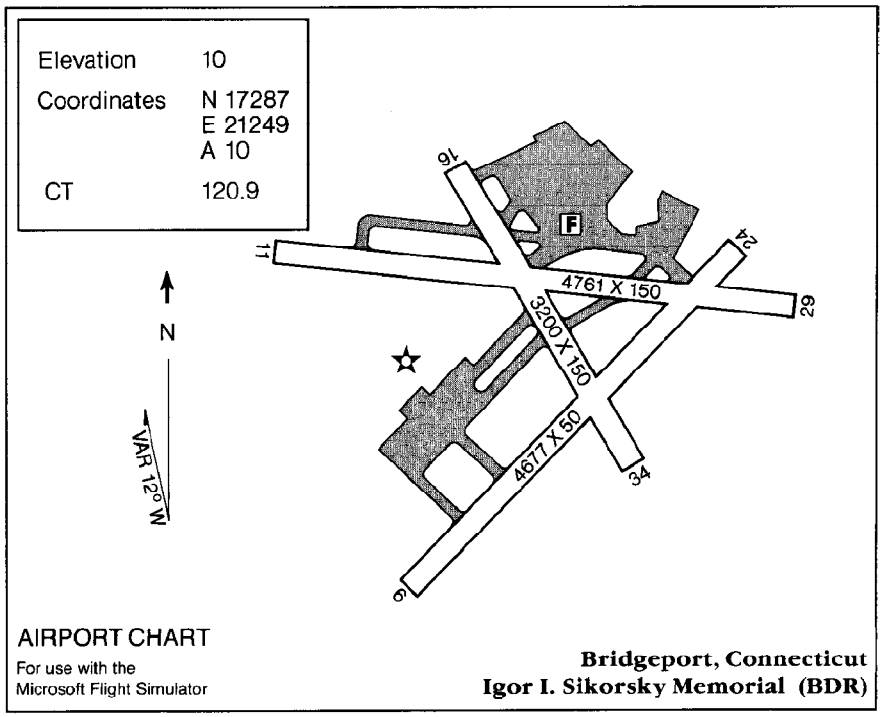
Avalon



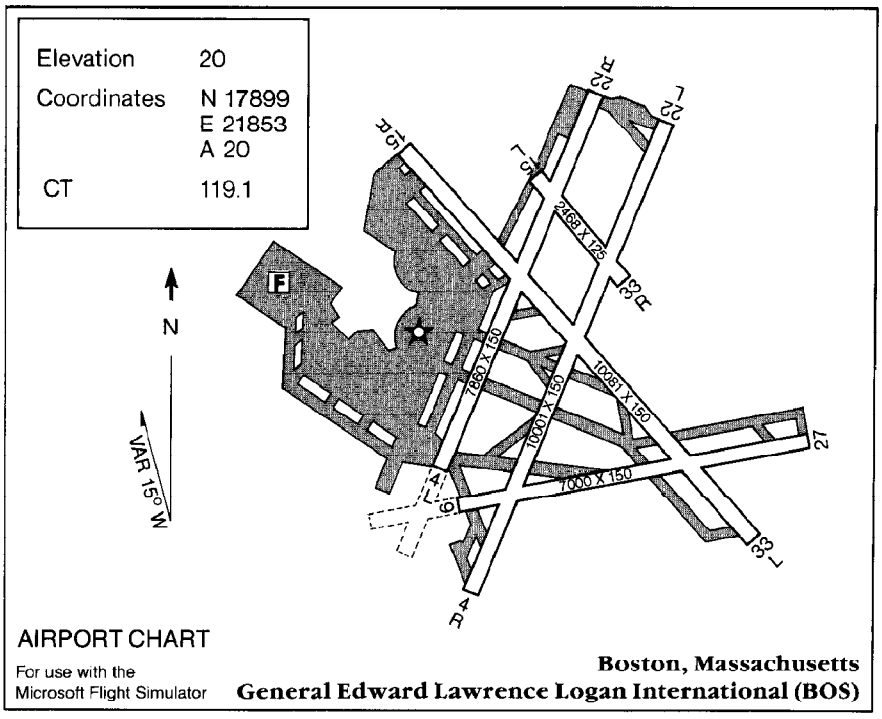
Block Island



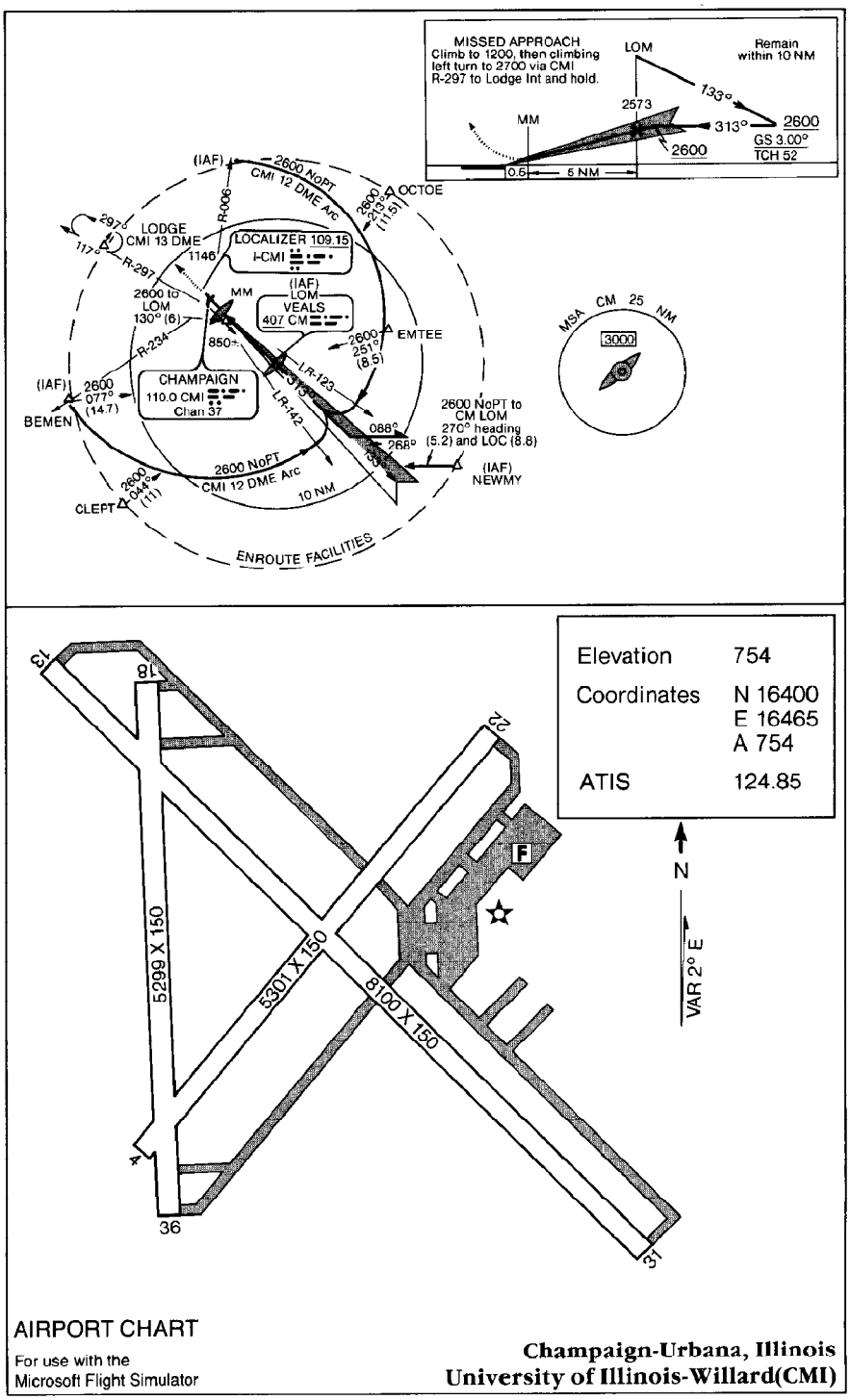
Bridgeport



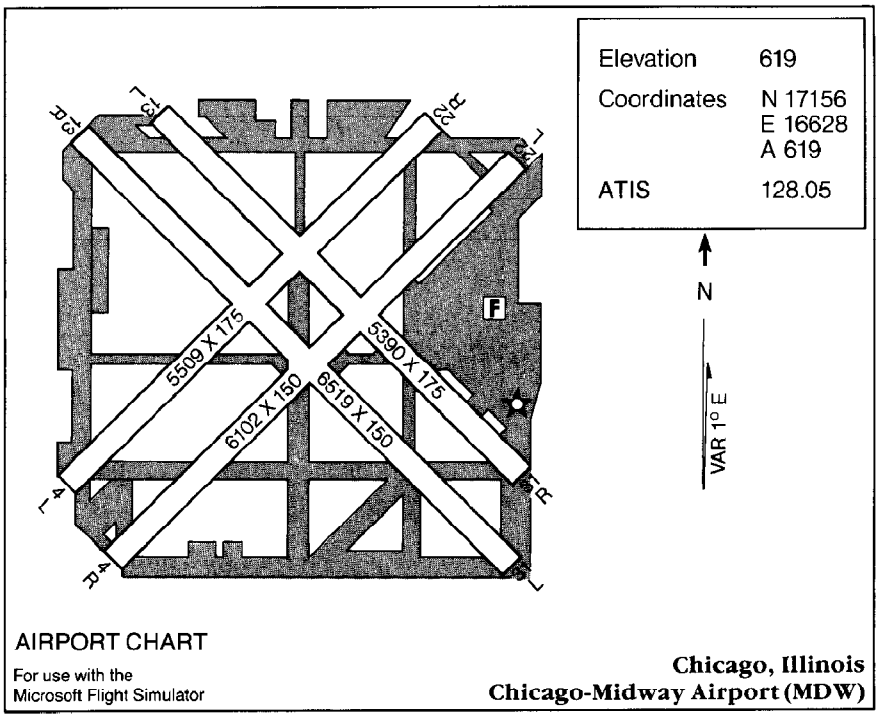
Boston

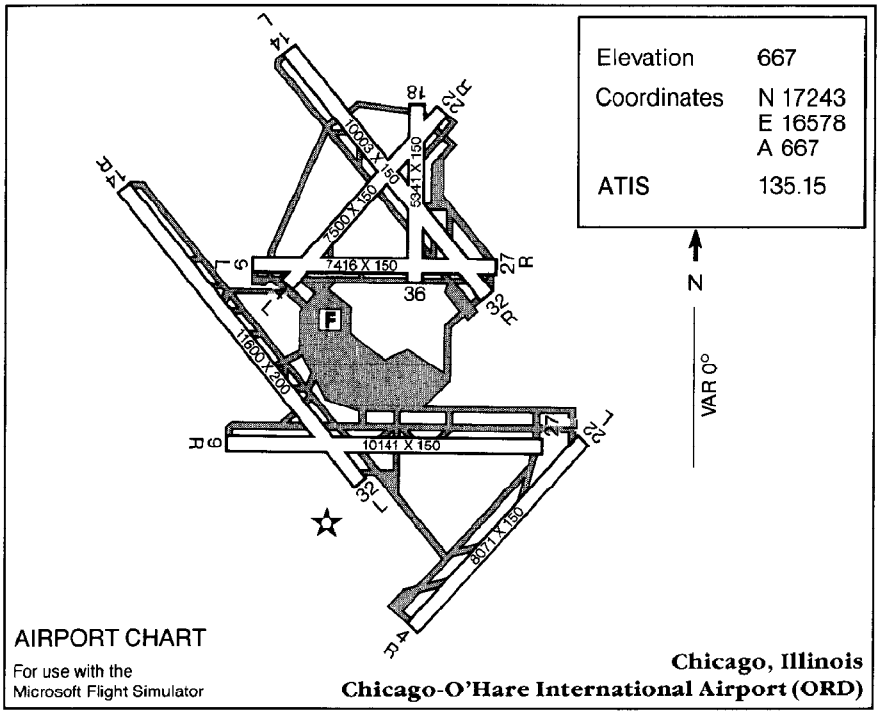


Champaign-Urbana



Chicago


Elevation 619
Coordinates N 17156
E 16628
A 619
ATIS 128.05
N
VAR 1° E
5509 X 175
5390 X 175
6102 X 150
6519 X 150
F
AIRPORT CHART
For use with the
Microsoft Flight Simulator
Chicago, Illinois
Chicago-Midway Airport (MDW)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A 667
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N
VAR 0°
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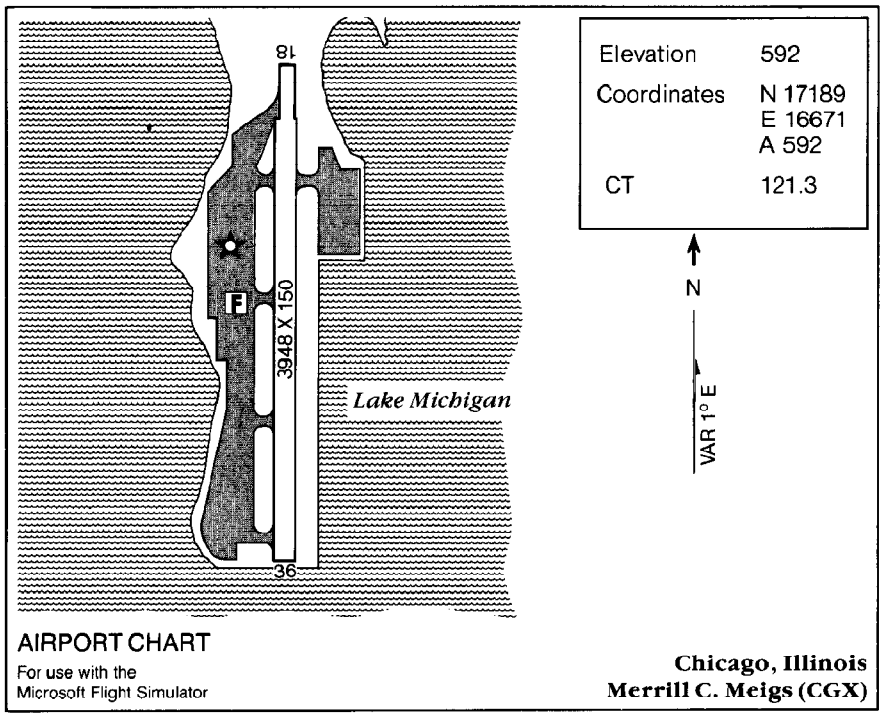
9341 X 150
7500 X 150
7416 X 150
10141 X 150
8071 X 150
F
AIRPORT CHART
For use with the
Microsoft Flight Simulator
Chicago, Illinois
Chicago-O'Hare International Airport (ORD)

Chicago


18
F
3948 X 150
Lake Michigan
36
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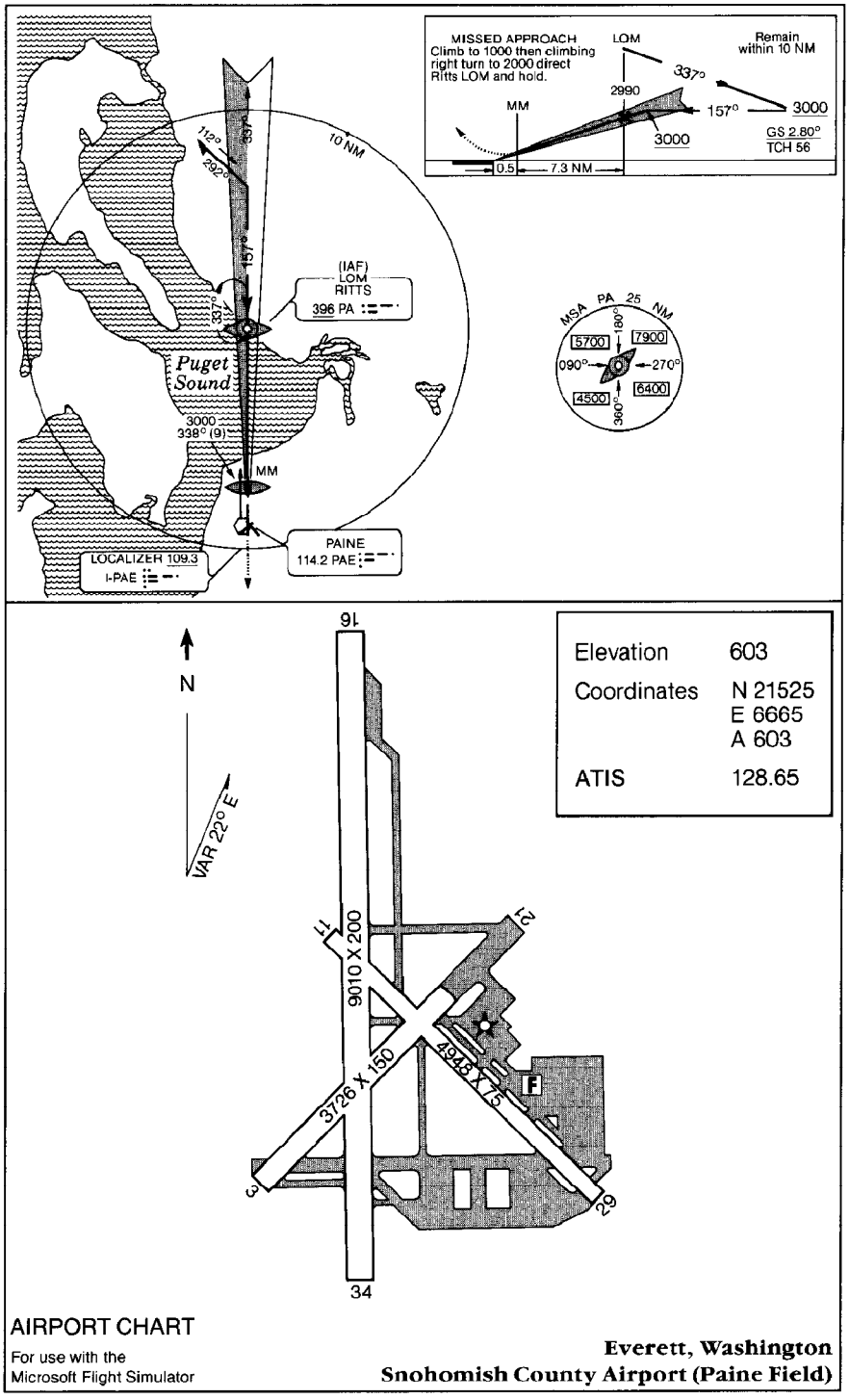
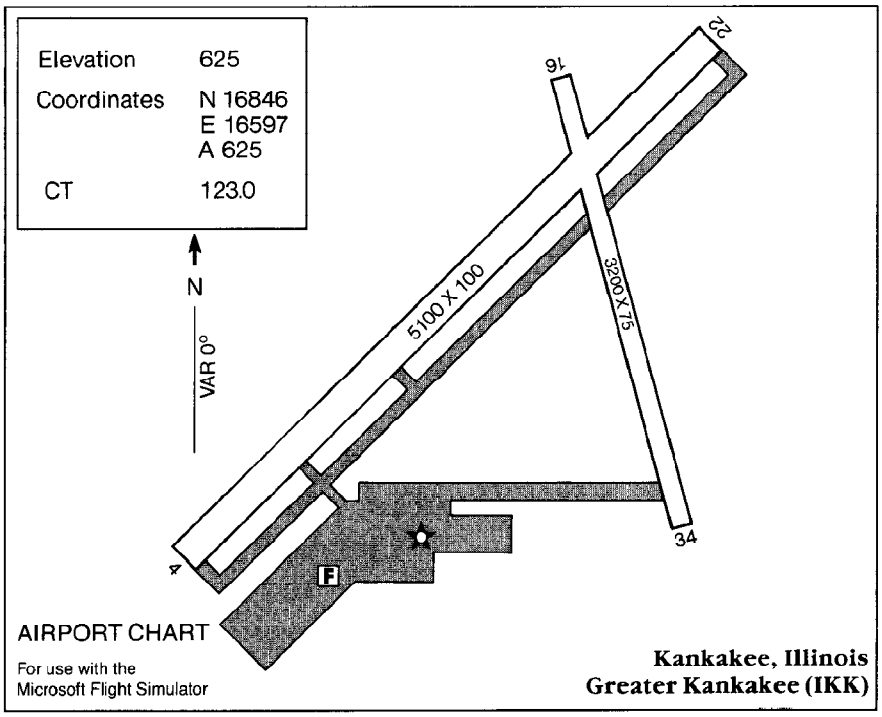
Coordinates N 17189
E 16671
A 592
CT 121.3
N
VAR 1° E
AIRPORT CHART
For use with the
Microsoft Flight Simulator
Chicago, Illinois
Merrill C. Meigs (CGX)

Everett


MISSED APPROACH
Climb to 1000 then climbing right turn to 2000 direct Ritts LOM and hold.
LOM
Remain within 10 NM
337°
2990
MM
157°
3000
3000
GS 2.80°
TCH 56
0.5
7.3 NM
10 NM
112°
292°
337°
157°
(IAF)
LOM
RITTS
396 PA
Puget Sound
3000
338° (9)
MM
PAINE
114.2 PAE
LOCALIZER 109.3
I-PAE
MSA PA 25 NM
5700
7900
090°
270°
4500
6400
180°
360°
N
VAR 22° E
16
34
11
21
29
9010 X 200
3726 X 150
4943 X 75
F
Elevation 603
Coordinates N 21525
E 6665
A 603
ATIS 128.65
AIRPORT CHART
For use with the
Microsoft Flight Simulator
Everett, Washington
Snohomish County Airport (Paine Field)

Kankakee



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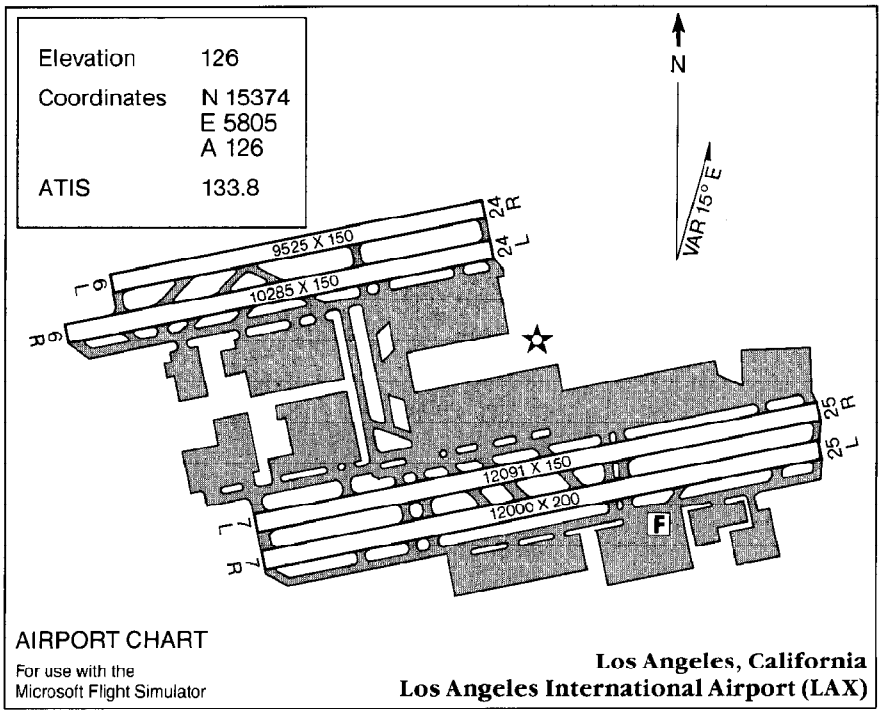

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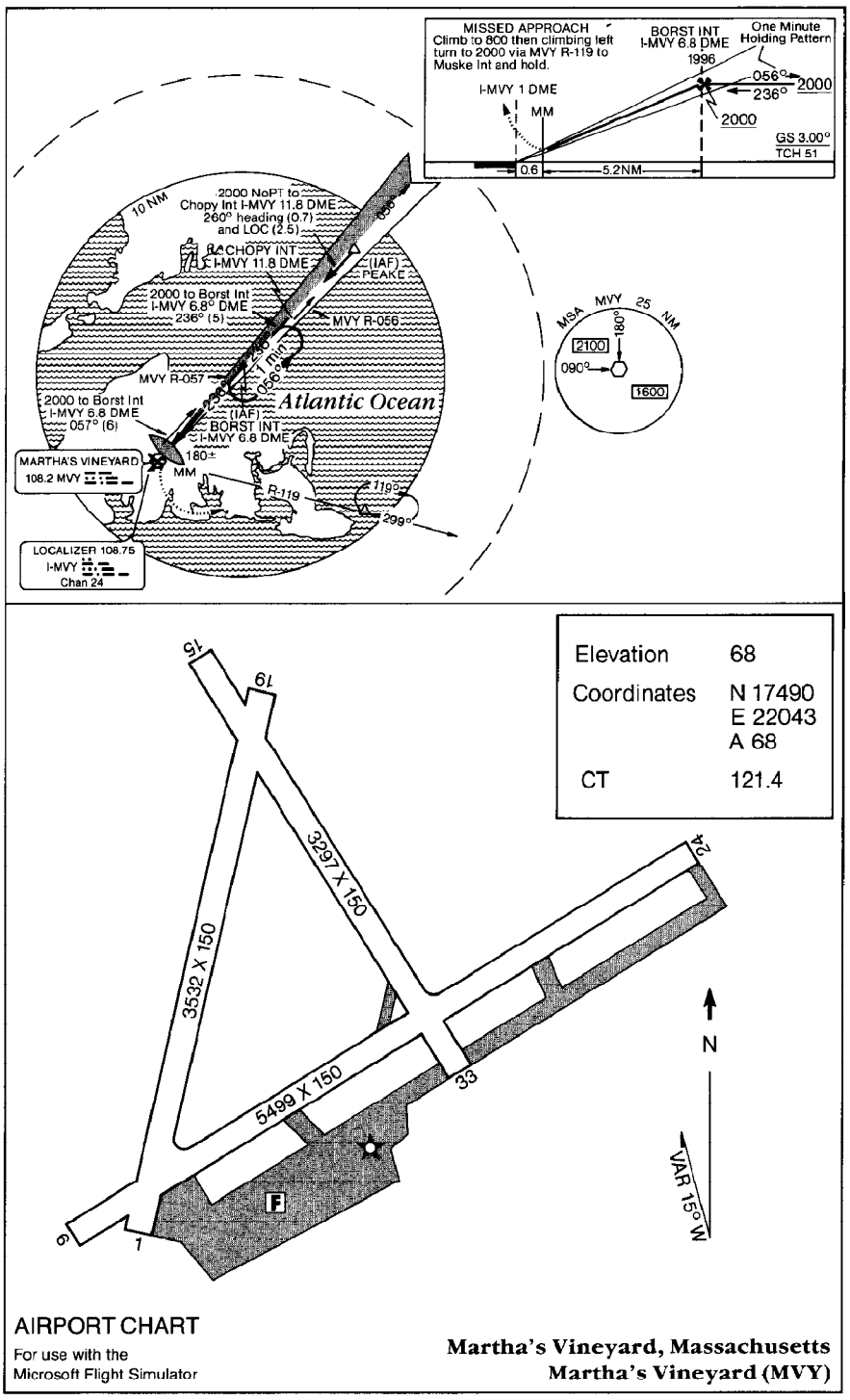

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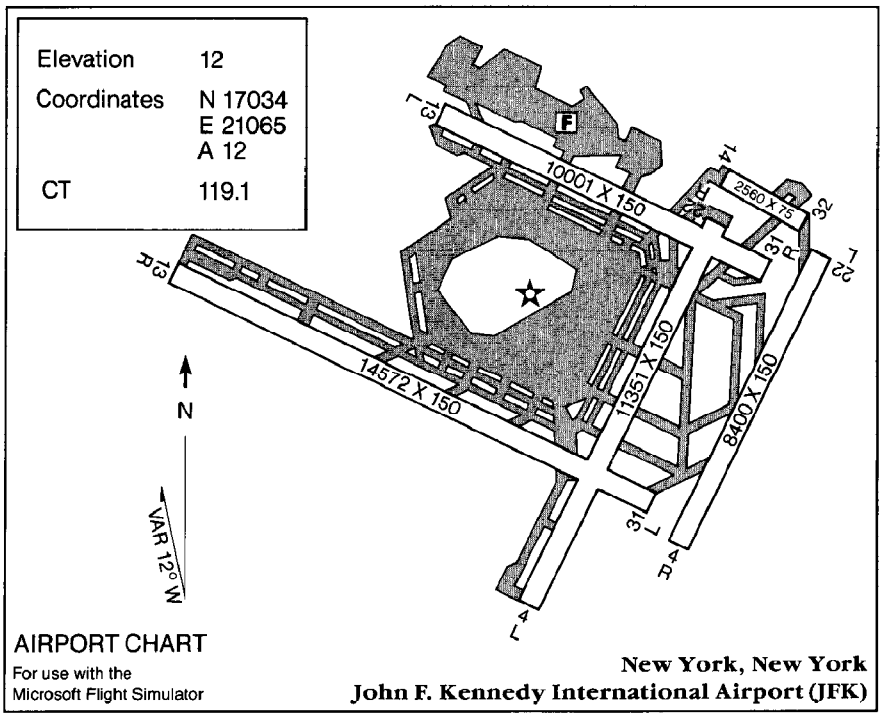

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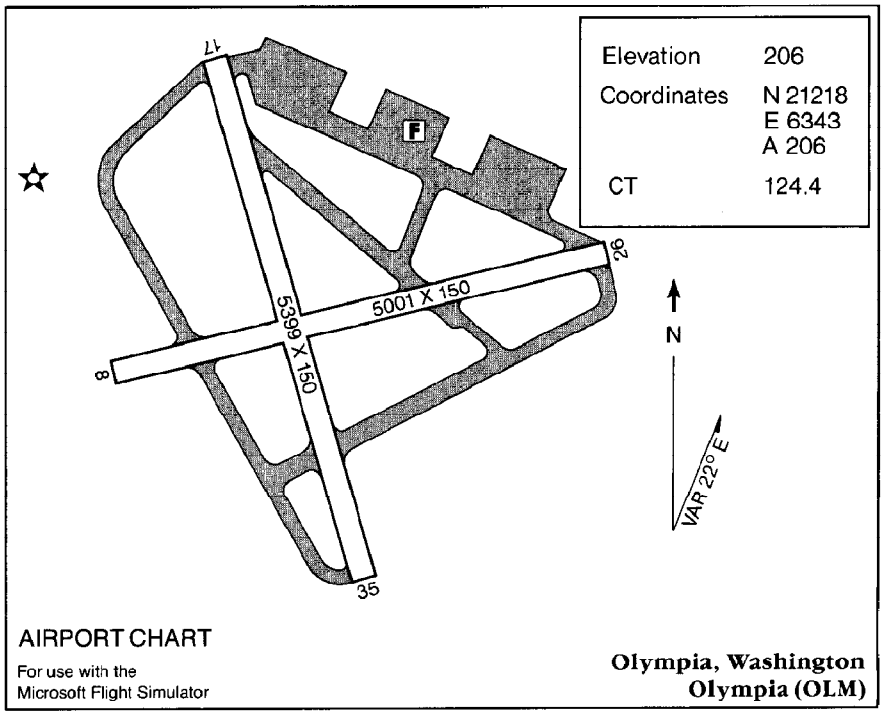
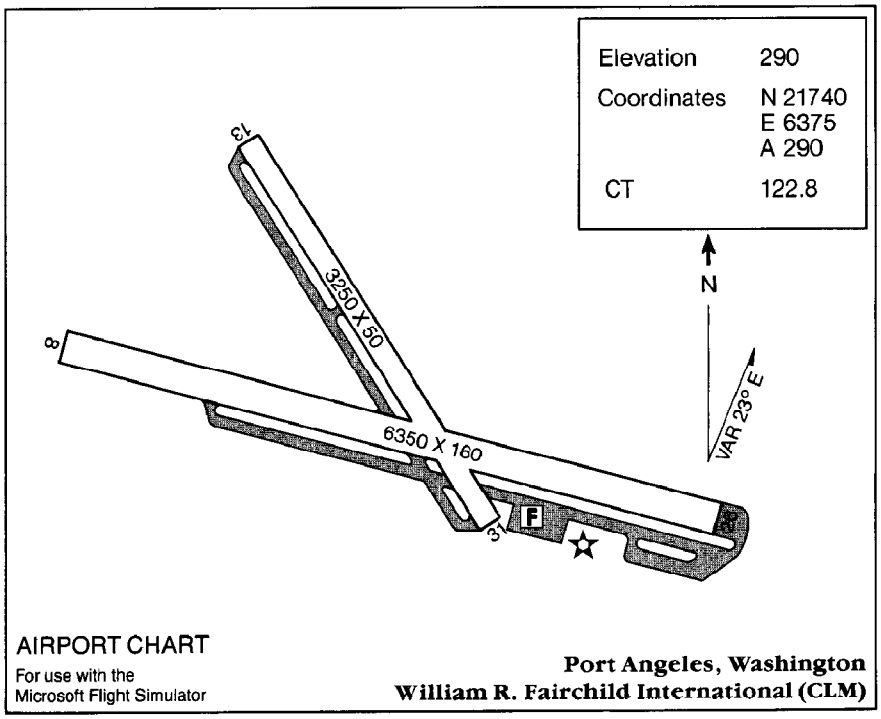


Port Angeles



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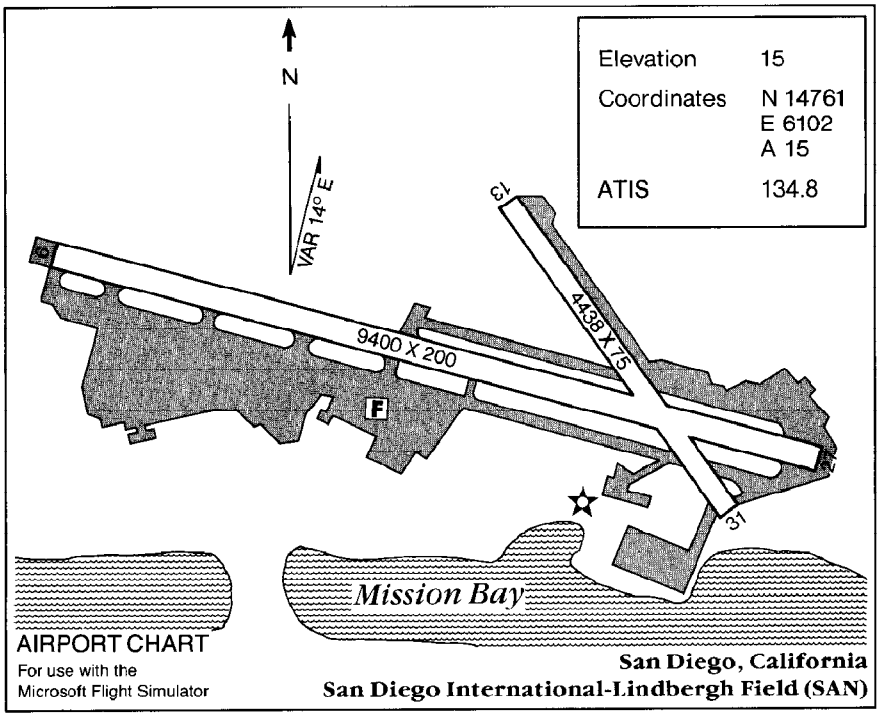
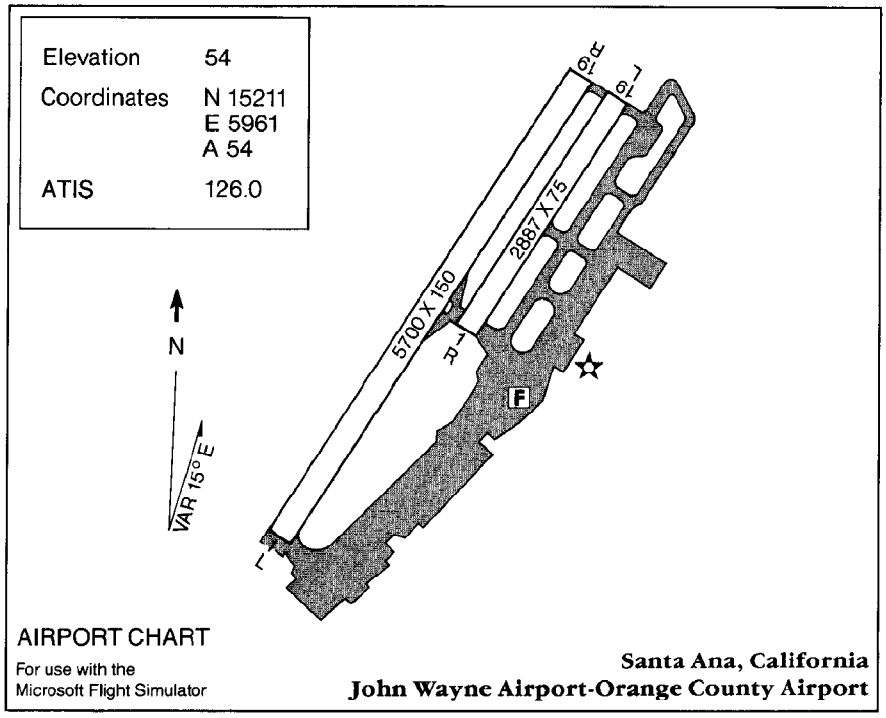


Santa Ana



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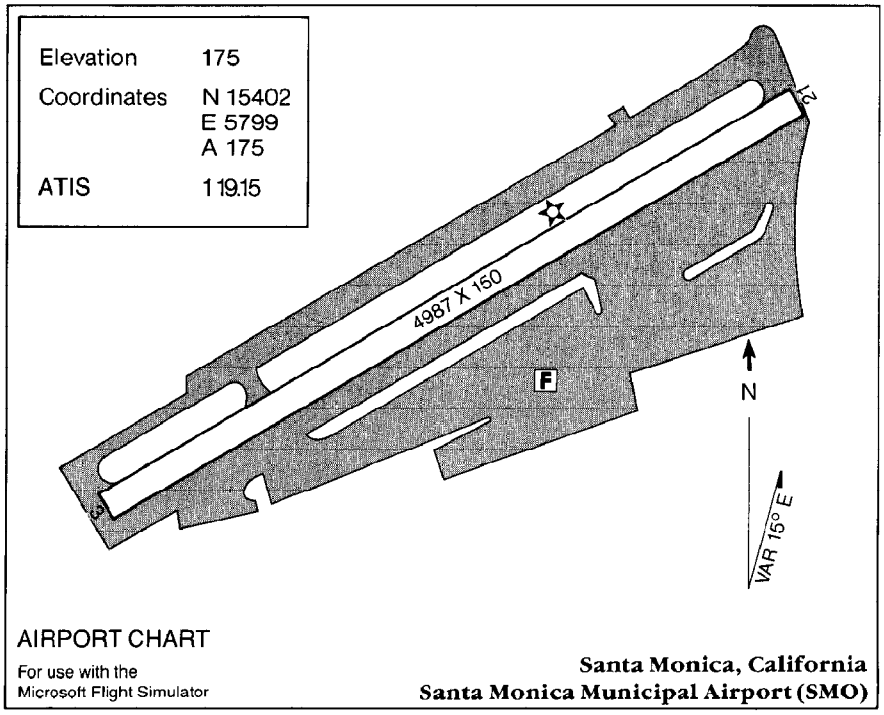

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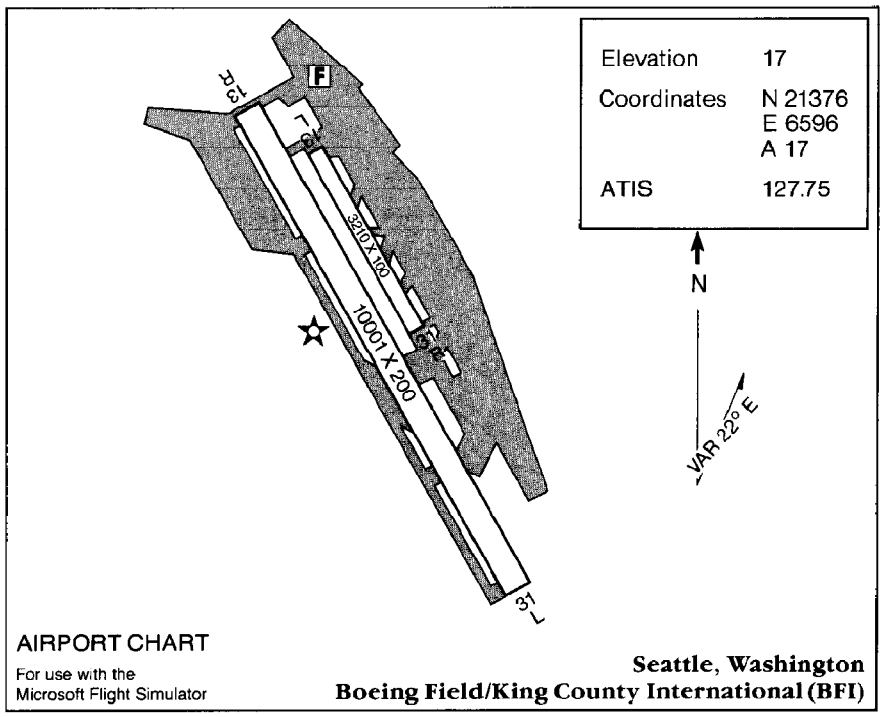
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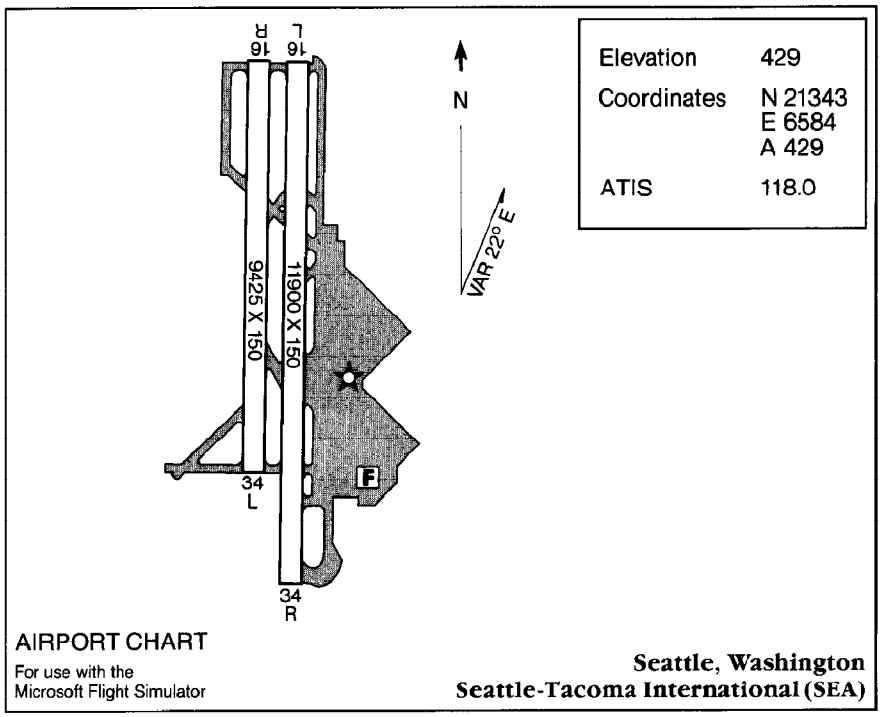
Coordinates N 21376
E 6596
A 17
ATIS 127.75
N
VAR 22° E
13R
13L
F
3210 X 100
10001 X 200
31R
31L
AIRPORT CHART
For use with the
Microsoft Flight Simulator
Seattle, Washington
Boeing Field/King County International (BFI)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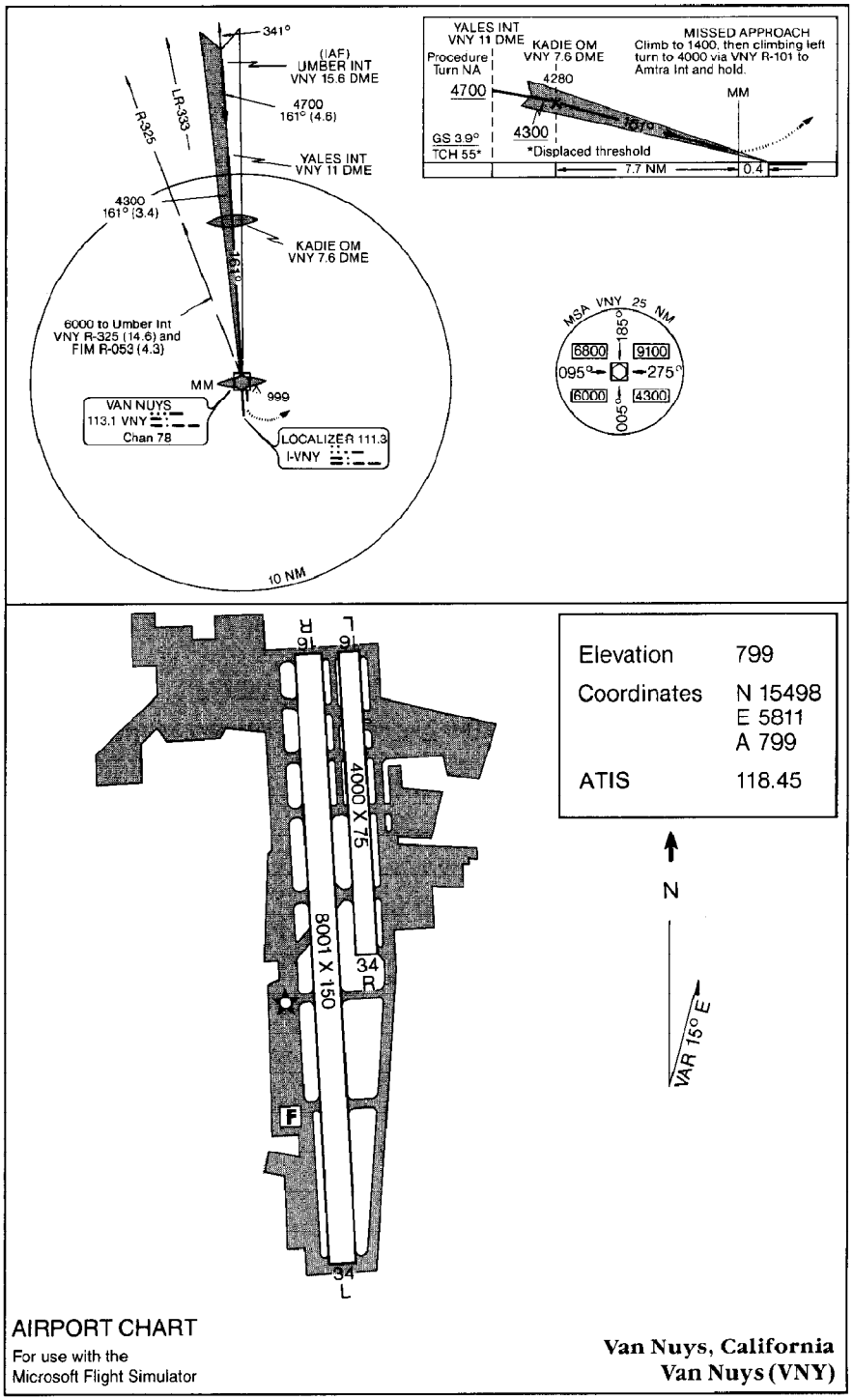
E 6584
A 429
ATIS 118.0
N
VAR 22° E
16R
16L
9425 X 150
11900 X 150
34L
34R
F
AIRPORT CHART
For use with the
Microsoft Flight Simulator
Seattle, Washington
Seattle-Tacoma International (SEA)

Van Nuys


341°
(IAF)
UMBER INT
VNY 15.6 DME
4700
161° (4.6)
YALES INT
VNY 11 DME
4300
161° (3.4)
KADIE OM
VNY 7.6 DME
6000 to Umber Int
VNY R-325 (14.6) and
FIM R-053 (4.3)
MM
999
VAN NUYS
113.1 VNY
Chan 78
LOCALIZER 111.3
I-VNY
10 NM
R-325
LR-333
YALES INT
VNY 11 DME
KADIE OM
VNY 7.6 DME
Procedure
Turn NA
4700
4280
4300
GS 3.9°
TCH 55*
*Displaced threshold
MM
MISSED APPROACH
Climb to 1400, then climbing left
turn to 4000 via VNY R-101 to
Amtra Int and hold.
7.7 NM
0.4
MSA VNY 25 NM
185°
6800
9100
095°
275°
6000
4300
005°
16R
16L
4000 X 75
8001 X 150
34
R
F
34
L
Elevation 799
Coordinates N 15498
E 5811
A 799
ATIS 118.45
N
VAR 15° E
AIRPORT CHART
For use with the
Microsoft Flight Simulator
Van Nuys, California
Van Nuys (VNY)

Appendix: Performance Specs

Flight Simulator Performance Specs

Length	28 ft.
Height	9 ft. 3 in.
Wingspan	36 ft.
Wing Area	174 sq. ft.
Maximum Takeoff Weight	3100 lb.
Empty Weight	1752 lb.
Maximum Useful Load	1360 lb.
Maximum Landing Weight	3100 lb.
Wing Loading	17.8 lb. per sq. ft.
Power Loading	13.2 lb. per hp
Maximum Usable Fuel	88 gal. (526 lb.)
Maximum Rate of Climb at Sea Level	1050 ft. per min.
Maximum Rate of Climb at 8000 ft.	455 ft. per min.
Service Ceiling	14900 ft.
Maximum Speed	146 knots
Cruise, 65% Power at 8000 ft.	133 knots
Endurance at 65% Power	7.5 hr.
Stall Speed Clean	54 knots
Stall Speed Flaps Down	49 knots
Turbulent Air Penetration Speed	110 knots
Landing Gear	Retractable tricycle, steerable nose-wheel

Glossary*

Active runway — Most large airports have more than one runway. It is usually impractical to have takeoffs and landings from more than one of them at a time (they usually cross each other so that the airport can handle planes taking off and landing under varying wind conditions). Therefore, the runway that is being used is called the "active runway."

Ailerons — The control surfaces on the outside trailing edge of the wings that control *roll*.

ATC — Air Traffic Control. The ground-based radio network consisting of Ground Control (controls taxiing to and from the *active runway*), Tower (controls the runway itself, giving permission to land and take off), Departure (controls the *airspace* immediately surrounding the airfield), Center (controls the airspace at higher altitudes), and Approach (controls those aircraft arriving into the airspace immediately surrounding the airfield).

Airfoil — A general term describing the wings, *vertical stabilizer*, *horizontal stabilizer*, etc. Engineers use the term to describe the special shape that produces lift.

Airspace — Roughly, the air around a given area. For example, the air around the United States is called "United States' airspace."

Airspeed indicator — The indicator that provides the aircraft's present indicated airspeed. See also *ground speed* and *true airspeed*.

* Terms printed in italics in the Glossary are defined elsewhere in the Glossary.

Altimeter	The indicator that gives information on the aircraft's present altitude. Usually calibrated to give Mean Sea Level (MSL) altitude. Most altimeters are called pressure altimeters because they measure the decrease in pressure as the aircraft climbs. It is due to this fact that the altimeter must be calibrated to the local *atmospheric pressure* to compensate for local variations in the pressure which would otherwise make the readings inaccurate.
Angle of attack	The angle between the wing's *chord* line and the relative wind.
Artificial horizon	The indicator that provides an in-the-cockpit reference for the attitude of the aircraft with respect to the ground. Used to provide attitude references in circumstances where the true horizon cannot be seen (e.g., flying into a cloud).
Atmospheric pressure	The pressure exerted by the air on the earth and everything on it. This is measured in inches (or millibars) of mercury on an instrument called a barometer. Thus, the term *barometric pressure* is frequently interchanged with atmospheric pressure. Typically, the pressure is between 28 and 32 inches of mercury at sea level.
Auto-coordinated	The term which describes the interconnection between the *rudder* and *ailerons* that automatically moves one as the pilot moves the other, resulting in properly coordinated turns (no *slips* or *skids*).
ATIS	Automatic Terminal Information Service. A continuous-loop recording played over a specified frequency giving weather and other important information on a given airfield. Usually updated once an hour. It is referred to by air traffic controllers by the *phonetic alphabet*.
Bank	See *roll*.
Barometric pressure	See *atmospheric pressure*.
Bleed off	The process where a given parameter (such as airspeed or altitude) is slowly decreased in a carefully controlled manner.

Canted gyroscope	A gyroscope within a flight instrument (usually the turn coordinator) with a rotational axis that is tilted or canted with relation to the aircraft's *longitudinal axis*. The tilted axis causes the gyro to respond to *rolling* or *yawing* motion.
Ceiling	The altitude of the base of the cloud cover.
Chord	The measurement of the wing taken from the leading edge to the trailing edge.
COM	Short for communications. Usually taken to mean the communications radio.
COM-NAV or NAV-COM	A radio that combines the functions of a communications radio with those of a navigational radio.
Control yoke	The control wheel and connections that control the *ailerons* and *elevator*. The ailerons are controlled by turning a "steering wheel," and the elevator is controlled by pushing the wheel toward or away from you.
Correction card	A card mounted near a magnetic compass that lists amounts of deviation to be expected between *magnetic* and indicated *headings*.
Density altitude	The altitude in the standard atmosphere (surface temperature 59° F and pressure 29.92 inches at sea level) where air has the same density as the air at the altitude being considered.
Dihedral	The angle (if any) that the wings are tilted upward. Upward dihedral, which forms a slight "V" shape as you look at an aircraft's front view, increases stability and tends to automatically level a plane after a turn.
Directional gyro	See *heading indicator*.
Distance Measuring Equipment (DME)	A radio that determines and displays distance from a VOR in nautical miles.
Drag	Those forces that oppose the movement of an aircraft through the air.

Elevators	The control surfaces on the trailing edge of the *horizontal stabilizer* that control the aircraft's *pitch*. When the elevators are down (the yoke is pushed forward), the stabilizer is pushed up by the air. This forces the nose down and causes the aircraft to dive. The opposite is true for climbs.
FAA	The Federal Aviation Administration. The agency (under the direction of the Department of Transportation) charged with maintaining safe and efficient use of the nation's *airspace* by military and civil aviators, for fostering civil aeronautics and air commerce in the U.S. and abroad, and for supporting the requirements of national defense.
Flaps	Movable *airfoil* sections, located on the trailing edge of the wings, that are lowered on takeoff and landing to increase the wings' lift and *drag*.
Flare	The last segment of a landing approach. It is the act of leveling off a foot or two above the runway prior to landing by raising the nose of the aircraft just prior to touchdown.
Glideslope	A navigation aid used on ILS approaches in the terminal area electronic navigation system that provides vertical guidance to aircraft as they approach the runway for landing.
Ground speed	The aircraft's actual speed relative to the ground. For example, if an aircraft is flying at 120 knots *true airspeed* and has a 15-knot headwind, its ground speed is 105 knots.
Heading	The direction that the aircraft is pointed. This is not necessarily the direction the plane is traveling. It is usually referred to as a magnetic heading, but "degrees" is typically omitted by experienced pilots ("My heading is 324").
Heading indicator (directional gyro)	A gyroscopically controlled compass that is designed to give *heading* information based on the forces acting upon a gyroscope, rather than any actual *magnetic* reading. It is used to provide a more accurate readout of heading without having to deal with magnetic compass lag and "settling time" after turns and climbs.

Horizontal stabilizer	The surface that is used to provide stabilization along the aircraft's lateral axis (helps to control *pitch*). Usually thought of as part of the airplane's "tail."
Instrument Flight Rules (IFR)	The "rules of the road" that cover flight in *Instrument Meteorological Conditions (IMC).*
Instrument Landing System (ILS)	A system of radio transmitters and receivers and special flight rules that provide a three-dimensional in-the-cockpit reference for landing. The radio signals consist of a localizer, which is very similar to a *VOR*, except that it only transmits a single very directional signal that will lead you to a specific runway at an airport on the correct *heading*; the *glideslope*, which does much the same, except that it does so in the vertical, thereby assuring that touchdown will be on the runway, and not before or after; outer, middle, and inner marker beacons that indicate distance from the runway; and approach lights. The instruments used are the glideslope needle and the localizer needle. These instruments are part of the *Omni-Bearing Indicator.*
Instrument Meteorological Conditions (IMC)	The weather conditions that force flight under *Instrument Flight Rules.*
Isogonic lines	Lines of equal *magnetic variation* of true north from magnetic north due to the different locations of the true and magnetic poles of the earth.
Knots	Nautical miles per hour. A "nautical mile" is described as 1 minute of longitude at the equator, or 1.15 "statute miles." To convert from knots to statute miles per hour, multiply knots by 1.1507. To convert the other way, multiply statute mph times .869.
Landing gear	The wheels, struts, etc. that the aircraft uses to land and maneuver on the ground. Landing gear typically come in one of two variations: "tail dragger," in which the aircraft seems to sit on its tail; and "tricycle," in which the plane sits level with the ground with one nose-wheel and two wheels farther back on the plane. The main landing gear are those nearest the aircraft's center of gravity, and almost always come in pairs (left and right main gear). They are designed to take more landing shock than the more fragile nose-wheel or tail-wheel.

Longitudinal axis	The imaginary axis running from front to rear through an aircraft's center of gravity and approximately parallel to the thrust line (the propeller's axis).
Magnetic	Refers to the reading on a magnetic compass.
Magnetic variation	The variation angle between "true north" and "magnetic north." This varies from location to location and must be taken into account for long-range navigation.
Magneto	A device that combines the functions of an automobile engine's coil and distributor. It takes energy from the aircraft engine in the form of rotational energy and, by use of magnetics and induced electricity, creates the high voltages required for the spark plugs.
Manually coordinated	The mode of flight in which the pilot coordinates the *ailerons* and *rudder* (see *auto-coordinated*).
NAV	Short for Navigational. Usually taken to mean the navigational radio.
Omni-Bearing Indicator (OBI)	The indicator that provides information about the aircraft's position relative to the presently tuned *VOR* station. Usually provides the ability to "dial in" or select a given course or radial, a TO-FROM indicator, and a Course Deviation Indicator (CDI). On aircraft with *ILS* capabilities, a Glideslope Deviation Indicator (GDI) is also incorporated in this instrument. There is no official name for this instrument. It is sometimes referred to as the Omni-Bearing Selector (OBS) or VOR receiver and indicator.

Phonetic alphabet

A special way of saying letters and numbers that makes them less likely to be misunderstood when they are transmitted over radios.

A	ALPHA	N	NOVEMBER	1	WUN
B	BRAVO	O	OSCAR	2	TOO
C	CHARLEY	P	PAPA	3	TREE
D	DELTA	Q	QUEBEC	4	FOWER
E	ECHO	R	ROMEO	5	FIVE
F	FOXTROT	S	SIERRA	6	SIX
G	GOLF	T	TANGO	7	SEVEN
H	HOTEL	U	UNIFORM	8	AIGHT
I	INDIA	V	VICTOR	9	NINER
J	JULIET	W	WHISKEY	0	ZEEROH
K	KILO	X	XRAY		
L	LIMA	Y	YANKEE		
M	MIKE	Z	ZULU		

In addition, numbers are usually spoken as individual digits. For example, 123 would be read as "wun too tree."

Pitch

The movement of the aircraft about its lateral axis (nose up or nose down). If the nose is pointed down, we say it is "pitched forward," and when it is pointed up, we say it is "pitched backwards."

Power glide

A long, shallow approach in which engine power is used to maintain the glide. Power glides should be avoided when they are not required to maintain *IFR* approach angles because engine failure can cause you to land short of the runway.

Radio stack

The area where the *COM*, *NAV*, and *transponder* radios are installed in the instrument panel. They are usually installed "on top of one another" as though they were stacked.

Rate of climb	The rate (measured in feet per minute) at which an aircraft is climbing. The term is also loosely stretched to include the rate of descent. The rate of climb is read on the *rate of climb indicator*. If an aircraft is at 1000 feet and is climbing at 500 feet per minute, then in 1 minute it will be at 1500 feet.
Rate of climb indicator	The indicator that gives information on the rate of increase and decrease of an aircraft's altitude. Also known as a "Vertical Speed Indicator" (VSI) or "Vertical Velocity Indicator" (VVI).
Roll	Those actions taking place about the aircraft's *longitudinal* (or roll) *axis*.
Rudder	The control surface, mounted on the trailing edge of the *vertical stabilizer* (the tail), that controls *yaw*.
Running lights	The anti-collision light system that is required by the *FAA* on an aircraft in flight. The system includes flashing or rotating beacon position lights (a red light on the left wingtip, a green on the right, and a white on the tail). These tell another aircraft which direction an aircraft is flying when only the lights can be seen.
Skid	An aircraft's sideways sliding away from the center of the curve while in a turn.
Slip	An aircraft's sideways motion while turning.
Standardized instrument cluster	An industry-accepted de facto standard for the placement of the six most commonly used flight instruments. The top row includes (from left to right): the *airspeed indicator*, attitude indicator, and *altimeter*. The bottom row includes (from left to right): the turn coordinator (or needle/ball), *heading indicator*, and *rate of climb indicator*.
Tachometer	The instrument that gives information concerning the speed of rotation of the engine. It is marked in rotations per minute (RPM).
Taxi	The action of moving the aircraft on the ground.
Throttle	The control that determines the speed of the engine.

Transponder	An airborne radio beacon transceiver that receives interrogation signals from *ATC* and selectively replies with a preset identification code (a "squawk code") set by the pilot. The squawk code is received by ATC and identifies and appears next to the aircraft on ATC radar.
Trim	The smaller control surfaces that affect the *elevators* in such a way as to make it less necessary to continually hold force on the yoke to maintain straight and level flight. Large aircraft also have *aileron* and *rudder* trim.
True airspeed	The actual speed of an aircraft through the air after compensating for *density altitude*.
Vertical stabilizer	The surface of the aircraft that is used to help control motion about the aircraft's vertical or *yaw* axis.
VOR	Short for Very high frequency Omnidirectional Range. This is a ground-based radio transmitter that provides positive guidance on pilot-selected *magnetic* course "radials" or straight lines. It is used in conjunction with the *NAV* radio and the VOR indicator. See the text for a discussion of its use.
Visual Flight Rules (VFR)	The "rules of the road" that cover flight in those conditions wherein flight can be safely controlled by "looking out the window."
Yaw	The rotation about the aircraft's vertical or yaw axis.

Index

MICROSOFT®
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Software Problem Report

Name _____

Street _____

City _____ State _____ Zip _____

Phone _____ Date _____

Instructions

Use this form to report software bugs, documentation errors, or suggested enhancements. Mail the form to Microsoft.

Category

_____ Software Problem

_____ Documentation Problem (Document#_____)

_____ Software Enhancement

_____ Other

Software Description

Microsoft Product _____

Rev. _____ Registration# _____

Operating System _____

Rev. _____ Supplier _____

Other Software Used _____

Rev. _____ Supplier _____

Hardware Description

Manufacturer _____ CPU _____ Memory _____ KB

Disk Size _____" Density: Sides:

Single _____ Single _____

Double _____ Double _____

Peripherals _____

Problem Description

Describe the problem. (Also describe how to reproduce it, and your diagnosis and suggested correction.) Attach a listing if available.

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Tech Support _____ Date Received _____

Routing Code _____ Date Resolved _____

Report Number _____

Action Taken:

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